Horner Syndrome

- **Cause:** *Sympathetic dysfunction*
- **Triad:**
  - Ptosis
  - Miosis
  - Anhidrosis
Horner Syndrome

- **Cause:** *Sympathetic dysfunction*
- **Triad:**
  - Ptosis
  - Miosis
  - Anhidrosis
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - **Ptosis**

*What does the term ‘ptosis’ mean in this context?*

Both

- The upper lid is too... low
- The lower lid is too... high
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - **Ptosis**

What does the term ‘ptosis’ mean in this context?
It describes an abnormal and unintended narrowing of the interpupillary fissure.
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - **Ptosis**

**What does the term ‘ptosis’ mean in this context?**

It describes an abnormal and unintended narrowing of the interpalpebral fissure.

**In Horner syndrome, does this ‘abnormal narrowing’ involve the upper lid, the lower lid, or both?**
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - Ptosis

*What does the term ‘ptosis’ mean in this context?*
It describes an abnormal and unintended narrowing of the interpalpebral fissure

*In Horner syndrome, does this ‘abnormal narrowing’ involve the upper lid, the lower lid, or both?*
Both
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - Ptosis
  - Miosis
  - Anhidrosis

What does the term ‘ptosis’ mean in this context?
It describes an abnormal and unintended narrowing of the interpalpebral fissure.

In Horner syndrome, does this ‘abnormal narrowing’ involve the upper lid, the lower lid, or both?
Both

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner’s?
The upper lid is too…
The lower lid is too…
Horner Syndrome

- Cause: *Sympathetic dysfunction*
- Triad:
  - **Ptosis**

What does the term ‘ptosis’ mean in this context?
It describes an abnormal and unintended narrowing of the interpupillary fissure.

In Horner syndrome, does this ‘abnormal narrowing’ involve the upper lid, the lower lid, or both?
Both

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner’s?
The upper lid is too...low
The lower lid is too...high
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - **Ptosis**

What does the term ‘ptosis’ mean in this context?
It describes an abnormal and unintended narrowing of the interpalpebral fissure.

In Horner syndrome, does this ‘abnormal narrowing’ involve the upper lid, the lower lid, or both?
Both

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner’s?
The upper lid is too…low.

The lower lid is too…high.

Note: Some authors refer to this malpositioning of the LL as *reverse* ptosis; however, to the best of my ability to ascertain, this term does not appear in any BCSC book.
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - **Ptosis**

**What does the term 'ptosis' mean in this context?**
It describes an abnormal and unintended narrowing of the interpalpebral fissure.

In Horner syndrome, does this 'abnormal narrowing' involve the upper lid, the lower lid, or both?
Both

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner's?
- The upper lid is too...low
- The lower lid is too...high

What muscle is most influential in terms of positioning the upper lid?
The levator palpebrae superioris

What nerve innervates the levator?
CN3

Is levator dysfunction implicated in the ptosis associated with Horner's?
No
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - **Ptosis**

What does the term 'ptosis' mean in this context?

It describes an abnormal and unintended narrowing of the interpalpebral fissure.

In Horner syndrome, does this 'abnormal narrowing' involve the upper lid, the lower lid, or both?

Both

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner's?

- The upper lid is too...low
- The lower lid is too...high

What muscle is most influential in terms of positioning the upper lid?

The levator palpebrae superioris

What nerve innervates the levator?

CN3

Is levator dysfunction implicated in the ptosis associated with Horner's?

No
Horner Syndrome

- **Cause:** *Sympathetic dysfunction*
- **Triad:**
  - **Ptosis**

What does the term 'ptosis' mean in this context?
It describes an abnormal and unintended narrowing of the interpalpebral fissure.

In Horner syndrome, does this 'abnormal narrowing' involve the upper lid, the lower lid, or both?
Both

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner's?
- The upper lid is too...low
- The lower lid is too...high

What muscle is most influential in terms of positioning the upper lid?
The levator palpebrae superioris

What nerve innervates the levator?
CN3

Is levator dysfunction implicated in the ptosis associated with Horner's?
No
Cause: Sympathetic dysfunction

Triad:

- **Ptosis**

*What does the term 'ptosis' mean in this context?*

It describes an abnormal and unintended narrowing of the interpalpebral fissure

*In Horner syndrome, does this 'abnormal narrowing' involve the upper lid, the lower lid, or both?*

Both

*With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner's?*

The upper lid is too...low

The lower lid is too...high

*What muscle is most influential in terms of positioning the upper lid?*

The levator palpebrae superioris

*What nerve innervates the levator?*

CN3

*Is levator dysfunction implicated in the ptosis associated with Horner's?*

No
Horner Syndrome

- Cause: *Sympathetic dysfunction*
- Triad:
  - **Ptosis**

What does the term ‘ptosis’ mean in this context?
It describes an abnormal and unintended narrowing of the interpalpebral fissure.

In Horner syndrome, does this ‘abnormal narrowing’ involve the upper lid, the lower lid, or both?
Both

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner’s?
- The upper lid is too...low
- The lower lid is too...high

What muscle is most influential in terms of positioning the upper lid?
The levator palpebrae superioris

What nerve innervates the levator?
CN3

Is levator dysfunction implicated in the ptosis associated with Horner’s?
No
Horner Syndrome

- **Cause:** Sympathetic dysfunction

- **Triad:**
  - **Ptosis**

What does the term 'ptosis' mean in this context?
It describes an abnormal and unintended narrowing of the interpalpebral fissure.

In Horner syndrome, does this 'abnormal narrowing' involve the upper lid, the lower lid, or both?
Both

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner's?
- The upper lid is too...low
- The lower lid is too...high

What muscle is most influential in terms of positioning the upper lid?
The levator palpebrae superioris

What nerve innervates the levator?
CN3

Is levator dysfunction implicated in the ptosis associated with Horner's?
No
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - Ptosis
  - Miosis
  - Anhidrosis

What does the term 'ptosis' mean in this context?

- It describes an abnormal and unintended narrowing of the interpalpebral fissure.

In Horner syndrome, does this 'abnormal narrowing' involve the upper lid, the lower lid, or both?

- Both

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner's?

- The upper lid is too...low
- The lower lid is too...high

What muscle is most influential in terms of positioning the upper lid?

- The levator palpebrae superioris

What nerve innervates the levator?

- CN3

Is levator dysfunction implicated in the ptosis associated with Horner's?

- No

If not the levator, what named muscle is implicated in the ptosis associated with Horner's?

- Müller's muscle

Are the fibers in Müller's muscle striated, or smooth?

- Smooth

Where is Müller's muscle located?

- It forms a narrow strip between the distal tendon of the levator and the tarsal plate of the upper lid.

If not the levator, what named muscle is implicated in the ptosis associated with Horner's?
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - **Ptosis**

What does the term 'ptosis' mean in this context? It describes an abnormal and unintended narrowing of the interpalpebral fissure.

In Horner syndrome, does this 'abnormal narrowing' involve the upper lid, the lower lid, or both? Both.

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner's? The upper lid is too...low, the lower lid is too...high.

What muscle is most influential in terms of positioning the upper lid? The levator palpebrae superioris.

What nerve innervates the levator? CN3.

Is levator dysfunction implicated in the ptosis associated with Horner's? No.

If not the levator, what named muscle is implicated in the ptosis associated with Horner's? Müller’s muscle.

Are the fibers in Müller’s muscle striated, or smooth? Smooth.

Where is Müller’s muscle located? It forms a narrow strip between the distal tendon of the levator and the tarsal plate of the upper lid.
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - **Ptosis**

What muscle is most influential in terms of positioning the upper lid?
The levator palpebrae superioris

What nerve innervates the levator?
CN3

Is levator dysfunction implicated in the ptosis associated with Horner's?
No

The upper lid is too...low
The lower lid is too...high

If not the levator, what named muscle is implicated in the ptosis associated with Horner's?
Müller’s muscle

Are the fibers in Müller’s muscle striated, or smooth?
Smooth

Where is Müller’s muscle located?
It forms a narrow strip between the distal tendon of the levator and the tarsal plate of the upper lid.
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - **Ptosis**

**What does the term 'ptosis' mean in this context?**
It describes an abnormal and unintended narrowing of the interpalpebral fissure.

In Horner syndrome, does this 'abnormal narrowing' involve the upper lid, the lower lid, or both?
Both

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner’s?
The upper lid is too...low
The lower lid is too...high

What muscle is most influential in terms of positioning the upper lid?
The levator palpebrae superioris

What nerve innervates the levator?
CN3

Is levator dysfunction implicated in the ptosis associated with Horner’s?
No

If not the levator, what named muscle is implicated in the ptosis associated with Horner’s?
Müller’s muscle

Are the fibers in Müller’s muscle striated, or smooth?
Smooth
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - Ptosis
  - Miosis
  - Anhidrosis

**What does the term 'ptosis' mean in this context?**
It describes an abnormal and unintended narrowing of the interpalpebral fissure.

**In Horner syndrome, does this 'abnormal narrowing' involve the upper lid, the lower lid, or both?**
Both

**With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner's?**
- The upper lid is too...low
- The lower lid is too...high

**What muscle is most influential in terms of positioning the upper lid?**
The *levator palpebrae superioris*

**What nerve innervates the *levator*?**
*CN3*

**Is *levator* dysfunction implicated in the ptosis associated with Horner’s?**
No

**If not the *levator*, what named muscle is implicated in the ptosis associated with Horner’s?**
*Müller’s muscle*

**Are the fibers in Müller’s muscle striated, or smooth?**
Smooth

**Smooth muscle fibers...What does this imply about the innervation of Müller’s muscle?**
It implies its innervation is via the ANS (in this case, the sympathetic branch of the ANS)
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - Ptosis
  - Miosis
  - Anhidrosis

What does the term 'ptosis' mean in this context?
It describes an abnormal and unintended narrowing of the interpalpebral fissure.

In Horner syndrome, does this 'abnormal narrowing' involve the upper lid, the lower lid, or both?
Both

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner's?
The upper lid is too...low
The lower lid is too...high

What muscle is most influential in terms of positioning the upper lid?
The levator palpebrae superioris

What nerve innervates the levator?
CN3

Is levator dysfunction implicated in the ptosis associated with Horner's?
No

If not the levator, what named muscle is implicated in the ptosis associated with Horner's?
Müller's muscle

Are the fibers in Müller's muscle striated, or smooth?
Smooth

Smooth muscle fibers...What does this imply about the innervation of Müller's muscle?
It implies its innervation is via the ANS (in this case, the sympathetic branch of the ANS).
Horner Syndrome

- **Cause:** *Sympathetic dysfunction*
- **Triad:**
  - **Ptosis**

What does the term 'ptosis' mean in this context? It describes an abnormal and unintended narrowing of the interpalpebral fissure.

In Horner syndrome, does this 'abnormal narrowing' involve the upper lid, the lower lid, or both? Both.

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner's? The upper lid is too...low. The lower lid is too...high.

What muscle is most influential in terms of positioning the upper lid? The *levator palpebrae superioris*.

What nerve innervates the levator? *CN 3*.

Is levator dysfunction implicated in the ptosis associated with Horner's? No.

If not the levator, what named muscle is implicated in the ptosis associated with Horner's? *Müller's muscle*.

Are the fibers in Müller’s muscle striated, or smooth? Smooth.

Where is Müller’s muscle located? It forms a narrow strip between the distal tendon of the levator and the tarsal plate of the upper lid.
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - Ptosis
  - Miosis
  - Anhidrosis

**What does the term 'ptosis' mean in this context?**
It describes an abnormal and unintended narrowing of the interpalpebral fissure.

In Horner syndrome, does this 'abnormal narrowing' involve the upper lid, the lower lid, or both?
Both

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner's?
The upper lid is too...low
The lower lid is too...high

What muscle is most influential in terms of positioning the upper lid?
The levator palpebrae superioris

What nerve innervates the levator?
CN3

Is levator dysfunction implicated in the ptosis associated with Horner's?
No

If not the levator, what named muscle is implicated in the ptosis associated with Horner's?
Müller's muscle

Are the fibers in Müller's muscle striated, or smooth?
Smooth

Where is Müller's muscle located?
It forms a narrow strip between the distal tendon of the levator and the tarsal plate of the upper lid.
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - Ptosis

**What does the term 'ptosis' mean in this context?**
It describes an abnormal and unintended narrowing of the interpalpebral fissure.

In Horner syndrome, does this 'abnormal narrowing' involve the upper lid, the lower lid, or both?
Both

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner's?
The upper lid is too... low
The lower lid is too... high

What muscle is most influential in terms of positioning the upper lid?
The levator palpebrae superioris

What nerve innervates the levator?
CN3

Is levator dysfunction implicated in the ptosis associated with Horner's? No

If not the levator, what named muscle is implicated in the ptosis associated with Horner's?
Müller's muscle

Are the fibers in Müller's muscle striated, or smooth?
Smooth

Where is Müller's muscle located?
It forms a narrow strip between the distal tendon of the levator and the tarsal plate of the upper lid.

If Müller’s muscle is in the upper lid, what accounts for the Horner-related ptosis of the lower lid?
The lower lid is too... high
Horner Syndrome

- **Cause:** Sympathetic dysfunction

- **Triad:**
  - Ptosis
  - Miosis
  - Anhidrosis

What does the term 'ptosis' mean in this context?

It describes an abnormal and unintended narrowing of the interpalpebral fissure.

In Horner syndrome, does this 'abnormal narrowing' involve the upper lid, the lower lid, or both?

Both

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner's?

The upper lid is too...low

The lower lid is too...high

What muscle is most influential in terms of positioning the upper lid?

The levator palpebrae superioris

What nerve innervates the levator?

CN3

Is levator dysfunction implicated in the ptosis associated with Horner's?

No

If not the levator, what named muscle is implicated in the ptosis associated with Horner's?

Müller's muscle

Are the fibers in Müller's muscle striated, or smooth?

Smooth

Where is Müller's muscle located?

It forms a narrow strip between the distal tendon of the levator and the tarsal plate of the upper lid.

If Müller's muscle is in the upper lid, what accounts for the Horner-related ptosis of the lower lid?

The lower lid contains a set of smooth-muscle fibers that function in a manner analogous to Müller's muscle, and are innervated in identical fashion. (These LL fibers are less-organized and far weaker than those comprising Müller's muscle.)
Horner Syndrome

- **Cause:** *Sympathetic dysfunction*
- **Triad:**
  - **Ptosis**

What muscle is most influential in terms of positioning the upper lid?
The levator palpebrae superioris

What nerve innervates the levator?
CN3

Is levator dysfunction implicated in the ptosis associated with Horner’s?
No

With regard to each lid, how are they (mal)positioned?
The upper lid is too... low
The lower lid is too... high

Does this collection of LL smooth muscle fibers have a name?
Not really (although it is sometimes referred to as the capsulopalpebral muscle because of its location)

If Müller’s muscle is in the upper lid, what accounts for the Horner-related ptosis of the lower lid?
The lower lid contains a set of smooth-muscle fibers that function in a manner analogous to Müller’s muscle, and are innervated in identical fashion. (These LL fibers are less organized and far weaker than those comprising Müller’s muscle.)

What nerve innervates Müller’s muscle?
CN3
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - **Ptosis**

What does the term 'ptosis' mean in this context?

It describes an abnormal and unintended narrowing of the interpalpebral fissure.

In Horner syndrome, does this 'abnormal narrowing' involve the upper lid, the lower lid, or both?

Both

With regard to each lid, how is it (mal)positioned in ptosis secondarily to Horner's?

The upper lid is too...low

The lower lid is too...high

What muscle is most influential in terms of positioning the upper lid?

The levator palpebrae superioris

What nerve innervates the levator?

CN3

Is levator dysfunction implicated in the ptosis associated with Horner's?

No

If not the levator, what named muscle is implicated in the ptosis associated with Horner's?

Müeller's muscle

Are the fibers in Müeller's muscle striated, or smooth?

Smooth

Where is Müeller's muscle located?

It forms a narrow strip between the distal tendon of the levator and the tarsal plate of the upper lid.

If Müeller's muscle is in the upper lid, what accounts for the Horner-related ptosis of the lower lid?

A set of smooth-muscle fibers

Does this collection of LL smooth muscle fibers have a name?

Not really (although it is sometimes referred to as the muscle because of its location)
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - **Ptosis**

**What muscle is most influential in terms of positioning the upper lid?**
The levator palpebrae superioris

**What nerve innervates the levator?**
CN3

**Is levator dysfunction implicated in the ptosis associated with Horner’s?**
No

With regard to each lid, how is it (mal)positioned in ptosis secondary to Horner’s?
The upper lid is too...low
The lower lid is too...high

The lower lid is too...high

**If Müller’s muscle is in the upper lid, what accounts for the Horner-related ptosis of the lower lid?**
A set of smooth-muscle fibers

The lower lid contains a set of smooth-muscle fibers that function in a manner analogous to Müller’s muscle, and are innervated in identical fashion. (These LL fibers are less organized and far weaker than those comprising Müller’s muscle.)

**Does this collection of LL smooth muscle fibers have a name?**
Not really (although it is sometimes referred to as the capsulopalpebral muscle because of its location)
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - Ptosis
  - **Miosis**

**How does sympathetic dysfunction result in a relatively miotic pupil?**
Horner Syndrome

- **Cause:** *Sympathetic dysfunction*
- **Triad:**
  - Ptosis
  - **Miosis**

*How does sympathetic dysfunction result in a relatively miotic pupil?*
At any given moment, the size of a pupil is determined by the sum total of sympathetic and parasympathetic innervation being received by its dilator and sphincter muscles, respectively. Thus, if the amount of sympathetic (=pro-dilating) innervation is reduced in one eye, its relatively unopposed parasympathetic (=pro-miosing) inputs will have an outsized effect, and its pupil will be relatively miosed in comparison to that of the fellow eye.
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - Ptosis
  - Miosis

‘Relatively miotic’ implies the pupils are not the same size. What term describes a state of unequal pupil sizes?

How does sympathetic dysfunction result in a relatively miotic pupil?
At any given moment, the size of a pupil is determined by the sum total of sympathetic and parasympathetic innervation being received by its dilator and sphincter muscles, respectively. Thus, if the amount of sympathetic (=pro-dilating) innervation is reduced in one eye, its relatively unopposed parasympathetic (=pro-miosing) inputs will have an outsized effect, and its pupil will be relatively miosed in comparison to that of the fellow eye.
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - Ptosis
  - Miosis

*Relatively miotic* implies the pupils are not the same size. What term describes a state of unequal pupil sizes? Anisocoria

How does sympathetic dysfunction result in a relatively miotic pupil? At any given moment, the size of a pupil is determined by the sum total of sympathetic and parasympathetic innervation being received by its dilator and sphincter muscles, respectively. Thus, if the amount of sympathetic (=pro-dilating) innervation is reduced in one eye, its relatively unopposed parasympathetic (=pro-miosis) inputs will have an outsized effect, and its pupil will be relatively miosed in comparison to that of the fellow eye.
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - Ptosis
  - Miosis

Relatively miotic implies the pupils are not the same size. What term describes a state of unequal pupil sizes? **Anisocoria**

When faced with anisocoria, what do you want to know first and foremost?

At any given moment, the size of a pupil is determined by the sum total of sympathetic and parasympathetic innervation being received by the dilator and sphincter muscles, respectively. Thus, if the amount of sympathetic (=pro-dilating) innervation is reduced in one eye, its relatively unopposed parasympathetic (=pro-miosing) inputs will have an outsized effect, and its pupil will be relatively miosed in comparison to that of the fellow eye.

When faced with anisocoria, first and foremost you want to know which pupil is 'the culprit'; i.e., is the larger pupil failing to constrict properly, or is the smaller pupil failing to dilate properly?

By determining the lighting condition under which the anisocoria is more pronounced. If the anisocoria is more pronounced in dim light, this indicates the smaller pupil isn’t dilating properly, and thus is abnormal. A pupil that fails to dilate is suggestive of a sympathetic problem. Likewise, if the anisocoria is more pronounced in bright light, the larger pupil isn’t constricting properly, and is therefore abnormal. A pupil that doesn’t constrict as it should is suggestive of a parasympathetic problem.
Horner Syndrome

- **Cause:** Sympathetic dysfunction

- **Triad:**
  - Ptosis
  - Miosis

‘Relatively miotic’ implies the pupils are not the same size. What term describes a state of unequal pupil sizes?

Anisocoria

When faced with anisocoria, what do you want to know first and foremost?
Which pupil (if either) is ‘the culprit’; ie, is the larger pupil failing to constrict properly, or is the smaller pupil failing to dilate properly?

At any given moment, the size of a pupil is determined by the sum total of sympathetic and parasympathetic innervation being received by its dilator and sphincter muscles, respectively. Thus, if the amount of sympathetic (=pro-dilating) innervation is reduced in one eye, its relatively unopposed parasympathetic (=pro-miosing) inputs will have an outsized effect, and its pupil will be relatively miosed in comparison to that of the fellow eye.

‘Relatively miotic’ implies the pupils are not the same size. What term describes a state of unequal pupil sizes?

Anisocoria

When faced with anisocoria, what do you want to know first and foremost?
Which pupil (if either) is ‘the culprit’; ie, is the larger pupil failing to constrict properly, or is the smaller pupil failing to dilate properly?

By determining the lighting condition under which the anisocoria is more pronounced. If the anisocoria is more pronounced in dim light, this indicates the smaller pupil isn't dilating properly, and thus is abnormal. A pupil that fails to dilate is suggestive of a sympathetic problem. Likewise, if the anisocoria is more pronounced in bright light, the larger pupil isn't constricting properly, and is therefore abnormal. A pupil that doesn't constrict as it should is suggestive of a parasympathetic problem.
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - Ptosis
  - Miosis

‘Relatively miotic’ implies the pupils are not the same size. What term describes a state of unequal pupil sizes?

Anisocoria

When faced with anisocoria, what do you want to know first and foremost?
Which pupil (if either) is ‘the culprit’; ie, is the larger pupil failing to constrict properly, or is the smaller pupil failing to dilate properly?

How can you tell which pupil is the culprit?

At any given moment, the size of a pupil is determined by the sum total of sympathetic and parasympathetic innervation being received by its dilator and sphincter muscles, respectively. Thus, if the amount of sympathetic (=pro-dilating) innervation is reduced in one eye, its relatively unopposed parasympathetic (=pro-miosing) inputs will have an outsized effect, and its pupil will be relatively miosed in comparison to that of the fellow eye.

‘Relatively miotic’ implies the pupils are not the same size.
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - Ptosis
  - Miosis

‘Relatively miotic’ implies the pupils are not the same size. What term describes a state of unequal pupil sizes?

**Anisocoria**

When faced with anisocoria, what do you want to know first and foremost?
Which pupil (if either) is ‘the culprit’; ie, is the larger pupil failing to constrict properly, or is the smaller pupil failing to dilate properly?

*How can you tell which pupil is the culprit?*
By determining the lighting condition under which the anisocoria is more pronounced. If the anisocoria is more pronounced in **dim** light, this indicates the smaller pupil isn’t dilating properly, and thus is abnormal. A pupil that fails to dilate is suggestive of a **ANS division** problem.
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - Ptosis
  - Miosis

‘Relatively miotic’ implies the pupils are not the same size. What term describes a state of unequal pupil sizes?

Anisocoria

When faced with anisocoria, what do you want to know first and foremost?
Which pupil (if either) is ‘the culprit’; ie, is the larger pupil failing to constrict properly, or is the smaller pupil failing to dilate properly?

How can you tell which pupil is the culprit?
By determining the lighting condition under which the anisocoria is more pronounced. If the anisocoria is more pronounced in dim light, this indicates the smaller pupil isn’t dilating properly, and thus is abnormal. A pupil that fails to dilate is suggestive of a sympathetic problem.
Horner Syndrome

- **Cause**: Sympathetic dysfunction
- **Triad**:
  - Ptosis
  - Miosis

‘Relatively miotic’ implies the pupils are not the same size. What term describes a state of unequal pupil sizes? **Anisocoria**

When faced with anisocoria, what do you want to know first and foremost?
Which pupil (if either) is ‘the culprit’; i.e., is the larger pupil failing to constrict properly, or is the smaller pupil failing to dilate properly?

How can you tell which pupil is the culprit?
By determining the lighting condition under which the anisocoria is more pronounced. If the anisocoria is more pronounced in **dim** light, this indicates the smaller pupil isn’t dilating properly, and thus is abnormal. A pupil that fails to dilate is suggestive of a sympathetic problem.
Likewise, if the anisocoria is more pronounced in **bright** light, the larger pupil isn’t constricting properly, and is therefore abnormal. A pupil that doesn’t constrict as it should is suggestive of a problem.
Horner Syndrome

- **Cause:** Sympathetic dysfunction
- **Triad:**
  - Ptosis
  - Miosis

‘Relatively miotic’ implies the pupils are not the same size. What term describes a state of unequal pupil sizes?

**Anisocoria**

When faced with anisocoria, what do you want to know first and foremost?
Which pupil (if either) is ‘the culprit’; i.e., is the larger pupil failing to constrict properly, or is the smaller pupil failing to dilate properly?

How can you tell which pupil is the culprit?
By determining the lighting condition under which the anisocoria is more pronounced. If the anisocoria is more pronounced in *dim* light, this indicates the smaller pupil isn’t dilating properly, and thus is abnormal. A pupil that fails to dilate is suggestive of a sympathetic problem. Likewise, if the anisocoria is more pronounced in *bright* light, the larger pupil isn’t constricting properly, and is therefore abnormal. A pupil that doesn’t constrict as it should is suggestive of a parasympathetic problem.
**Horner Syndrome**

- **Cause:** *Sympathetic dysfunction*
- **Triad:**
  - Ptosis
  - Miosis

‘Relatively miotic’ implies the pupils are not the same size. What term describes a state of unequal pupil sizes? **Anisocoria**

When faced with anisocoria, what do you want to know first and foremost? Which pupil (if either) is ‘the culprit’; i.e., is the larger pupil failing to constrict properly, or is the smaller pupil failing to dilate properly?

How can you tell which pupil is the culprit? By determining the lighting condition under which the anisocoria is more pronounced. If the anisocoria is more pronounced in **dim** light, this indicates the smaller pupil isn’t dilating properly, and is therefore abnormal. A pupil that fails to dilate is suggestive of a sympathetic problem. Likewise, if the anisocoria is more pronounced in **bright** light, the larger pupil isn’t constricting properly, and is therefore abnormal. A pupil that doesn’t constrict as it should is suggestive of a parasympathetic problem.

What if the anisocoria is the same under all lighting conditions? Then it is **nonpathologic** or physiological anisocoria (a common finding).
Horner Syndrome

- **Cause:** *Sympathetic dysfunction*
- **Triad:**
  - Ptosis
  - Miosis

‘Relatively miotic’ implies the pupils are not the same size. What term describes a state of unequal pupil sizes?

**Anisocoria**

When faced with anisocoria, what do you want to know first and foremost?

- Which pupil (if either) is ‘the culprit’—is the larger pupil failing to constrict properly, or is the smaller pupil failing to dilate properly?

How can you tell which pupil is the culprit?

By determining the lighting condition under which the anisocoria is more pronounced. If the anisocoria is more pronounced in **dim** light, this indicates the smaller pupil isn’t dilating properly, and thus is abnormal. A pupil that fails to dilate is suggestive of a sympathetic problem.

Likewise, if the anisocoria is more pronounced in **bright** light, the larger pupil isn’t constricting properly, and is therefore abnormal. A pupil that doesn’t constrict as it should is suggestive of a parasympathetic problem.

What if the anisocoria is the same under all lighting conditions?

Then it is nonpathologic or **physiological anisocoria** (a common finding)
Horner Syndrome

- Cause: *Sympathetic dysfunction*
- Triad:
  - Ptosis
  - Miosis

‘Relatively miotic’ implies the pupils are not the same size. What term describes a state of unequal pupil sizes?

Anisocoria

When faced with anisocoria, what do you want to know first and foremost?

Which pupil (if either) is ‘the culprit’, i.e., is the larger pupil failing to constrict properly, or is the smaller pupil failing to dilate properly?

How can you tell which pupil is the culprit?

By determining the lighting condition under which the anisocoria is more pronounced. If the anisocoria is more pronounced in dim light, this indicates the smaller pupil isn’t dilating properly, and thus is abnormal. A pupil that fails to dilate is suggestive of a sympathetic problem. Likewise, if the anisocoria is more pronounced in bright light, the larger pupil isn’t constricting properly, and is therefore abnormal. A pupil that doesn’t constrict as it should is suggestive of a parasympathetic problem.

What if the anisocoria is the same under all lighting conditions?

Then it is nonpathologic or physiological anisocoria (a common finding).

Next we will embark on an extensive review of the sympathetic pathway as it relates to the eye and orbit. Buckle up!
Neural pathway in Horner syndrome:

First of three components

Second of three components

Third of three components
Horner Syndrome

*Neural pathway in Horner syndrome:*
First-order neurons

Second-order neurons

Third-order neurons
Horner Syndrome

*Neural pathway in Horner syndrome:*

**First-order neurons**
--- Originate in hypothalamus
--- Travels in spinal cord
--- Synapses in ciliospinal center of Budge

**Second-order neurons**
--- Originates at Budge center
--- Exits spinal cord
--- Travels in sympathetic chain
--- Synapses in superior cervical ganglion

**Third-order neurons**
--- Originates in superior cervical ganglion
--- Travels with internal carotid artery into cavernous sinus
--- Hops onto VI, then V1 to enter orbit
Horner Syndrome

*Neural pathway in Horner syndrome:*

**First-order neurons**
--Originate in hypothalamus

**Second-order neurons**

**Third-order neurons**
Horner Syndrome

*Neural pathway in Horner syndrome:*

**First-order neurons**
--Originate in hypothalamus
--Travel in spinal cord

**Second-order neurons**

**Third-order neurons**
Horner Syndrome

*Neural pathway in Horner syndrome:*

First-order neurons
--Originate in hypothalamus
--Travel in spinal cord

Second-order neurons

Third-order neurons
Horner Syndrome

*Neural pathway in Horner syndrome:*

**First-order neurons**
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in four words

**Second-order neurons**

**Third-order neurons**
Horner Syndrome

*Neural pathway in Horner syndrome:*

**First-order neurons**
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

**Second-order neurons**

**Third-order neurons**
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons

Third-order neurons

At what level of the spinal cord is the center of Budge found?
Horner Syndrome

*Neural pathway in Horner syndrome:*
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in *ciliospinal center of Budge*

Second-order neurons

Third-order neurons

---

At what level of the spinal cord is the center of Budge found? C8-T2
Horner Syndrome

*Neural pathway in Horner syndrome:*

**First-order neurons**
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

**Second-order neurons**
--Originate at Budge center
--Exit

**Third-order neurons**
Horner Syndrome

*Neural pathway in Horner syndrome:*

**First-order neurons**
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in cilio-spinal center of Budge

**Second-order neurons**
--Originate at Budge center
--Exit spinal cord

**Third-order neurons**
Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons
--Originate at Budge center
--Exit spinal cord
--Travel in two words

Third-order neurons
Horner Syndrome

*Neural pathway in Horner syndrome:*

**First-order neurons**
- Originate in hypothalamus
- Travel in spinal cord
- Synapse in ciliospinal center of Budge

**Second-order neurons**
- Originate at Budge center
- Exit spinal cord
- Travel in sympathetic chain

**Third-order neurons**
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain

Third-order neurons

What major structure do these fibers pass over?

Horner Syndrome

*Neural pathway in Horner syndrome:*

**First-order neurons**
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

**Second-order neurons**
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain

**Third-order neurons**

*What major structure do these fibers pass over?*  
The lung apex
Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in three words

Third-order neurons
Horner Syndrome

*Neural pathway in Horner syndrome:*

**First-order neurons**
- Originate in hypothalamus
- Travel in spinal cord
- Synapse in ciliospinal center of Budge

**Second-order neurons**
- Originate at Budge center
- Exit spinal cord
- Travel in sympathetic chain
- Synapse in superior cervical ganglion

**Third-order neurons**
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion aka...?

Third-order neurons

By what other name is the superior cervical ganglion known?
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion aka...the stellate ganglion

Third-order neurons

By what other name is the superior cervical ganglion known?
The stellate ganglion
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons *aka...?*
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion *aka...the stellate ganglion*

Third-order neurons

*By what other name is the superior cervical ganglion known?*
The **stellate ganglion**

*Speaking of other names…The second-order neurons are often referred to by another name, one owing to the relationship between these neurons and the ganglion to which they are headed. What is that name?*
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons *aka*...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion *aka*...the stellate ganglion

Third-order neurons

*By what other name is the superior cervical ganglion known?*
The **stellate ganglion**

*Speaking of other names...The second-order neurons are often referred to by another name, one owing to the relationship between these neurons and the ganglion to which they are headed. What is that name?*

**Pre-ganglionic** neurons
Horner Syndrome

*Neural pathway in Horner syndrome:*

**First-order neurons**
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliiospinal center of Budge

**Second-order neurons** aka...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion aka...the stellate ganglion

**Third-order neurons**
--Originate in superior cervical ganglion

(No question—proceed when ready)
Horner Syndrome

*Neural pathway in Horner syndrome:*
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons *aka...pre-ganglionic neurons*
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion *aka...the stellate ganglion*

Third-order neurons *aka...?*
--Originate in superior cervical ganglion

Likewise, the third-order neurons are also referred to by a term owing to their relationship with the stellate ganglion. What is that term?
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons aka...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion aka...the stellate ganglion

Third-order neurons aka...post-ganglionic neurons
--Originate in superior cervical ganglion

Likewise, the third-order neurons are also referred to by a term owing to their relationship with the stellate ganglion. What is that term?
Post-ganglionic neurons
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons aka...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion aka...the stellate ganglion

Third-order neurons aka...post-ganglionic neurons
--Originate in superior cervical ganglion
--Travel with three words to enter the two words
Horner Syndrome

_Neural pathway in Horner syndrome:_

**First-order neurons**
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

**Second-order neurons** _aka...pre-ganglionic neurons_
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion _aka...the stellate ganglion_

**Third-order neurons** _aka...post-ganglionic neurons_
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons aka...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion aka...the stellate ganglion

Third-order neurons aka...post-ganglionic neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
----Fibers bound for the pupil join cranial nerve, then different cranial nerve
Horner Syndrome

*Neural pathway in Horner syndrome:*

**First-order neurons**
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

**Second-order neurons aka...pre-ganglionic neurons**
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion aka...the stellate ganglion

**Third-order neurons aka...post-ganglionic neurons**
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
----Fibers bound for the pupil join CN6, then V1
Horner Syndrome

*Neural pathway in Horner syndrome:*
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons *aka...pre-ganglionic neurons*
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain

*For how long do these pupil-bound postganglionic sympathetic fibers run with CN6?*

--In the sinus:

----Fibers bound for the pupil join CN6, then V1
Horner Syndrome

*Neural pathway in Horner syndrome:*
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons *aka*...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain

*For how long do these pupil-bound postganglionic sympathetic fibers run with CN6?*
Not long--just a few millimeters

---Fibers bound for the pupil join CN6, then V1
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons aka...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain

For how long do these pupil-bound postganglionic sympathetic fibers run with CN6? 
Not long--just a few millimeters

If it’s so trivial, why bother mentioning the relationship at all?

----Fibers bound for the pupil join  CN6 , then  V1
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons aka...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain

For how long do these pupil-bound postganglionic sympathetic fibers run with CN6?
Not long--just a few millimeters

If it’s so trivial, why bother mentioning the relationship at all?
Because of its importance in lesion localization. If a pt presents with a LR palsy + ipsilateral miotic pupil, the lesion must be located in the cavernous sinus!

----Fibers bound for the pupil join CN6, then V1
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originated in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons
--Originated at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion

Third-order neurons
--Originated in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
----Fibers bound for the pupil join CN6, then V1
Neural pathway in Horner syndrome:
First-order neurons
--Originates in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge
Second-order neurons
--Originates at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion
Third-order neurons
--Originates in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
----Fibers bound for the pupil join CN6, then V1

V1 (aka the ophthalmic nerve)
Neural pathway in Horner syndrome:

First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion

Third-order neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
----Fibers bound for the pupil join CN6, then V1

V1 (aka the ophthalmic nerve) breaks into three branches. What are they?
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
-- Synapse in the ciliospinal center of Budge

Second-order neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in the superior cervical ganglion

Third-order neurons
--Originate in the superior cervical ganglion
--Travel with the internal carotid artery to enter the cavernous sinus
--In the sinus:
----Fibers bound for the pupil join CN6, then V1

V1 (aka the ophthalmic nerve) breaks into three branches. What are they?

--- Mnemonic forthcoming…
Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons
--Originates in hypothalamus
--Travel in the spinal cord
--Synapse in the ciliospinal center of Budge

Second-order neurons
--Originates at Budge center
--Exits spinal cord
--Travel in the sympathetic chain
--Synapse in the superior cervical ganglion

Third-order neurons
--Originates in the superior cervical ganglion
--Travel with the internal carotid artery to enter the cavernous sinus
--In the sinus:
----Fibers bound for the pupil join CN6, then V1

V1 (aka the ophthalmic nerve) breaks into three branches. What are they?

-N
-F
-L

Mnemonic forthcoming…
Neural pathway in Horner syndrome:

First-order neurons:
-- Originate in hypothalamus
-- Travel in spinal cord
-- Synapse in ciliospinal center of Budge

Second-order neurons:
-- Originate at Budge center
-- Exit spinal cord
-- Travel in sympathetic chain
-- Synapse in superior cervical ganglion

Third-order neurons:
-- Originate in superior cervical ganglion
-- Travel with internal carotid artery to enter the cavernous sinus
-- In the sinus:
--- Fibers bound for the pupil join CN6, then V1

V1 (aka the ophthalmic nerve) breaks into three branches. What are they?
-- Nasociliary
-- Frontal
-- Lacrimal

Mnemonic forthcoming...
Neural pathway in Horner syndrome:

First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion

Third-order neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus: ----Fibers bound for the pupil join CN6, then V1

V1 (aka the ophthalmic nerve) breaks into three branches. What are they?
--Nasociliary
--Frontal
--Lacrimal

With which branch do the postganglionic sympathetics run?

Horner Syndrome
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion

Third-order neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
----Fibers bound for the pupil join CN6, then V1

V1 (aka the ophthalmic nerve) breaks into three branches. What are they?
--Nasociliary
--Frontal
--Lacrimal

With which branch do the postganglionic sympathetics run?
The nasociliary
Neural pathway in Horner syndrome:

First-order neurons
-- Originate in hypothalamus
-- Travel in spinal cord
-- Synapse in ciliospinal center of Budge

Second-order neurons
-- Originate at Budge center
-- Exit spinal cord
-- Travel in sympathetic chain
-- Synapse in superior cervical ganglion

Third-order neurons
-- Originate in superior cervical ganglion
-- Travel with internal carotid artery to enter the cavernous sinus
-- In the sinus:
---- Fibers bound for the pupil join CN6, then V1

V1 (aka the ophthalmic nerve) breaks into three branches. What are they?
-- Nasociliary
-- Frontal
-- Lacrimal

With which branch do the postganglionic sympathetics run?
The nasociliary

The nasociliary nerve also carries preganglionic parasympathetics in need of a ganglion in which to synapse. To which ganglion are these fibers headed?
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originates in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons
--Originates at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion

Third-order neurons
--Originates in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
- Fibers bound for the pupil join CN6, then V1

V1 (aka the ophthalmic nerve) breaks into three branches. What are they?
--Nasociliary
--Frontal
--Lacrimal

With which branch do the postganglionic sympathetics run?
The nasociliary

The nasociliary nerve also carries preganglionic parasympathetics in need of a ganglion in which to synapse. To which ganglion are these fibers headed?
The ciliary ganglion
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion

Third-order neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
----Fibers bound for the pupil join CN6, then V1

V1 (aka the ophthalmic nerve) breaks into three branches. What are they?
--Nasociliary
--Frontal
--Lacrimal

With which branch do the postganglionic sympathetics run?
The nasociliary

The nasociliary nerve also carries preganglionic parasympathetics in need of a ganglion in which to synapse. To which ganglion are these fibers headed?
The ciliary ganglion

Will the sympathetics synapse in the ciliary ganglion as well?
No. Remember, these are postganglionic sympathetics. They will pass through the ganglion without synapsing.
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion

Third-order neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
----Fibers bound for the pupil join CN6, then V1

V1 (aka the ophthalmic nerve) breaks into three branches. What are they?
--Nasociliary
--Frontal
--Lacrimal

With which branch do the postganglionic sympathetics run?
The nasociliary

The nasociliary nerve also carries preganglionic parasympathetics in need of a ganglion in which to synapse. To which ganglion are these fibers headed?
The ciliary ganglion

Will the sympathetics synapse in the ciliary ganglion as well?
No. Remember, these are postganglionic sympathetics. They will pass through the ganglion without synapsing.
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion

Third-order neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
----Fibers bound for the pupil join CN6, then V1

V1 (aka the ophthalmic nerve) breaks into three branches. What are they?
--Nasociliary
--Frontal
--Lacrimal

With which branch do the postganglionic sympathetics run?
The nasociliary

The nasociliary nerve also carries preganglionic parasympathetics in need of a ganglion in which to synapse. To which ganglion are these fibers headed?
The ciliary ganglion

Upon leaving the ganglion, with which nerves do the sympathetics ride on their way to the dilator muscle?

The long ciliary nerves
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Origin in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons
--Origin at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion

Third-order neurons
--Origin in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
---Fibers bound for the pupil join CN6, then V1

V1 (aka the ophthalmic nerve) breaks into three branches. What are they?
--Nasociliary
--Frontal
--Lacrimal

With which branch do the postganglionic sympathetics run?
The nasociliary

The nasociliary nerve also carries preganglionic parasympathetics in need of a ganglion in which to synapse. To which ganglion are these fibers headed?
The ciliary ganglion

Upon leaving the ganglion, with which nerves do the sympathetics ride on their way to the dilator muscle?
The long ciliary nerves
Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons aka...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion aka...the stellate ganglion

Third-order neurons aka...post-ganglionic neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
----Fibers bound for the pupil join CN6, then V1
----Fibers bound for Mueller’s muscle, as well as...

(No question—proceed when ready)
Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons aka... pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion aka... the stellate ganglion

Third-order neurons aka... post-ganglionic neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
----Fibers bound for the pupil join CN6, then V1
----Fibers bound for Mueller’s muscle, as well as…
----Fibers bound for sweat glands of the forehead hop onto the artery, and then onto its [yellow] and [yellow] branches
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons aka...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion aka...the stellate ganglion

Third-order neurons aka...post-ganglionic neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
----Fibers bound for the pupil join CN6, then V1
----Fibers bound for Mueller’s muscle, as well as...
----Fibers bound for sweat glands of the forehead hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches
Horner Syndrome

*Neural pathway in Horner syndrome:*

First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons *aka...pre-ganglionic neurons*
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion *aka...the stellate ganglion*

Third-order neurons *aka...post-ganglionic neurons*

*What about sweat glands of the lower face--how do sympathetics get to them?*

----Fibers bound for Mueller’s muscle, as well as the rest of the face
----Fibers bound for sweat glands of the forehead hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in cilioospinal center of Budge

Second-order neurons *aka*...**pre-ganglionic neurons**
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion *aka*...**the stellate ganglion**

Third-order neurons *aka*...**post-ganglionic neurons**
--- *What about sweat glands of the lower face--how do sympathetics get to them?*
--- Postganglionic fibers destined to innervate lower-face sweat glands don’t run with the internal carotid; rather, at the carotid bulb they hop onto the **external** carotid, then onto its branches to reach their destinations on the non-forehead face.
--- Fibers bound for Mueller’s muscle, as well as the rest of the face.
--- Fibers bound for sweat glands of the forehead hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches.
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in cilioispinal center of Budge

Second-order neurons aka...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion aka...the stellate ganglion

Third-order neurons aka...post-ganglionic neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus

What about fibers bound for the lacrimal gland--do they pass through the cavernous sinus as well?

Fibers bound for sweat glands of the forehead hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches
--Fibers bound for the lacrimal gland?
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons aka...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion aka...the stellate ganglion

Third-order neurons aka...post-ganglionic neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus

What about fibers bound for the lacrimal gland--do they pass through the cavernous sinus as well?
No--these hop off the internal carotid before it enters the sinus, and join the preganglionic parasympathetic fibers on their way to innervate the gland

Fibers bound for the lacrimal gland of the forehead hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches
Horner Syndrome

*Neural pathway in Horner syndrome:*
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons *aka...pre-ganglionic neurons*
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion *aka...the stellate ganglion*

Third-order neurons *aka...post-ganglionic neurons*
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus

What about fibers bound for the lacrimal gland--do they pass through the cavernous sinus as well?
No--these hop off the internal carotid before it enters the sinus, and join the preganglionic parasympathetic fibers on their way to innervate the gland

Fibers bound for the lacrimal gland so they hop off the internal carotid before it enters the sinus, and join the preganglionic parasympathetic fibers on their way to innervate the gland

These preganglionic parasympathetic fibers ‘belong’ to which cranial nerve?
Horner Syndrome

*Neural pathway in Horner syndrome:*
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons *aka*...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion *aka*...the stellate ganglion

Third-order neurons *aka*...post-ganglionic neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus

*What about fibers bound for the lacrimal gland--do they pass through the cavernous sinus as well?*
No--these hop off the internal carotid *before* it enters the sinus, and join the preganglionic parasympathetic fibers on their way to innervate the gland

*Fibers bound for the lacrimal gland?*
These preganglionic parasympathetic fibers *belong* to which cranial nerve? CN7
Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in cilioospinal center of Budge

Second-order neurons \textit{aka...pre-ganglionic neurons}
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion \textit{aka...the stellate ganglion}

Third-order neurons \textit{aka...post-ganglionic neurons}
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus

\textit{What about fibers bound for the lacrimal gland--do they pass through the cavernous sinus as well?}
No--these hop off the internal carotid \textbf{before} it enters the sinus, and join the \textbf{preganglionic parasympathetic fibers on their way to innervate the gland}

\textit{These preganglionic parasympathetic fibers form a named nerve--what is its name?} Cranial nerve?
Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons *aka...pre-ganglionic neurons*
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion *aka...the stellate ganglion*

Third-order neurons *aka...post-ganglionic neurons*
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus

What about fibers bound for the lacrimal gland--do they pass through the cavernous sinus as well?
No--these hop off the internal carotid before it enters the sinus, and join the preganglionic parasympathetic fibers on their way to innervate the gland

These preganglionic parasympathetic fibers form a named nerve--what is its name? *Cranial nerve?*
The greater petrosal nerve
Neural pathway in Horner syndrome:
First-order neurons
---Originate in hypothalamus
---Travel in spinal cord
---Synapse in ciliospinal center of Budge

Second-order neurons aka...pre-ganglionic neurons
---Originate at Budge center
---Exit spinal cord
---Travel in sympathetic chain
---Synapse in superior cervical ganglion aka...the stellate ganglion

Third-order neurons aka...post-ganglionic neurons
---Originate in superior cervical ganglion
---Travel with internal carotid artery to enter the cavernous sinus
---In the sinus:
---Fibers bound for the pupil join CN6, then V1
---Fibers bound for Mueller's muscle
---Fibers bound for sweat glands of the forehead hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches

What about fibers bound for the lacrimal gland—do they pass through the cavernous sinus as well?

These postganglionic sympathetic fibers form a named nerve of their own—what is its name?

These preganglionic parasympathetic fibers form a named nerve—what is its name? What is the cranial nerve?

The greater petrosal nerve
Horner Syndrome

*Neural pathway in Horner syndrome:*
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons *aka...pre-ganglionic neurons*
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion *aka...the stellate ganglion*

Third-order neurons *aka...post-ganglionic neurons*
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus

*What about fibers bound for the lacrimal gland*--do they pass through the

*These postganglionic sympathetic fibers form a named nerve of their own--what is its name?*
The deep petrosal nerve

*These preganglionic parasympathetic fibers form a named nerve--what is its name?*
The greater petrosal nerve
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliосospinal center of Budge

Second-order neurons aka...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion aka...the stellate ganglion

Third-order neurons aka...post-ganglionic neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus

What about fibers bound for the lacrimal gland? Do they pass through the cavernous sinus as well?
No
--These hop off the internal carotid before it enters the sinus, and join the preganglionic parasympathetic fibers on their way to innervate the gland

Once the deep petrosal and greater petrosal nerves join up, they form a new named nerve--what is its name?
The deep petrosal nerve
These preganglionic parasympathetic fibers form a named nerve--what is its name? The greater petrosal nerve

The deep petrosal nerve
These postganglionic sympathetic fibers on their way to innervate the gland
The greater petrosal nerve
These preganglionic parasympathetic fibers form a named nerve--what is its name?
Horner Syndrome

*Neural pathway in Horner syndrome:*

**First-order neurons**
-- Originate in hypothalamus
-- Travel in spinal cord
-- Synapse in ciliospinal center of Budge

**Second-order neurons aka...pre-ganglionic neurons**
-- Originate at Budge center
-- Exit spinal cord
-- Travel in sympathetic chain
-- Synapse in superior cervical ganglion aka...the stellate ganglion

**Third-order neurons aka...post-ganglionic neurons**
-- Originate in superior cervical ganglion
-- Travel with internal carotid artery to enter the cavernous sinus
**What about fibers bound for the lacrimal gland?**
do they pass through the cavernous sinus as well?
No
-- these hop off the internal carotid before it enters the sinus, and join the preganglionic parasympathetic fibers on their way to innervate the gland

*These preganglionic parasympathetic fibers form a named nerve--what is its name?*
*The greater petrosal nerve*

*Once the deep petrosal and greater petrosal nerves join up, they form a new named nerve--what is its name?*
*The vidian nerve*

*These preganglionic parasympathetic fibers on their way to innervate the gland form a named nerve--what is its name?*
*Cranial nerve 7*

Once the deep petrosal and greater petrosal nerves join up, they form a new named nerve--what is its name? The **vidian nerve**
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Origin in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons aka...pre-ganglionic neurons
--Origin at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion aka...the stellate ganglion

Third-order neurons aka...post-ganglionic neurons
--Origin in superior cervical ganglion
--Travel with internal carotid artery
--In the sinus:
----Fibers bound for the pupil join CN6, then V1
----Fibers bound for Mueller's muscle
----Fibers bound for sweat glands of the forehead hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches

What about fibers bound for the lacrimal gland—do they pass through the cavernous sinus as well?
No—these hop off the internal carotid before it enters the sinus, and join the preganglionic parasympathetic fibers on their way to innervate the gland

These postganglionic sympathetic fibers form a named nerve of their own—what is its name?
The deep petrosal nerve

By what passage does the vidian nerve exit the skull?

The vidian nerve aka...
The greater petrosal nerve

These preganglionic parasympathetic fibers form a named nerve—what is its name?
The cranial nerve?
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
-- Originate in hypothalamus
-- Travel in spinal cord
-- Synapse in ciliospinal center of Budge

Second-order neurons aka... pre-ganglionic neurons
-- Originate at Budge center
-- Exit spinal cord
-- Travel in sympathetic chain
-- Synapse in superior cervical ganglion aka... the stellate ganglion

Third-order neurons aka... post-ganglionic neurons
-- Originate in superior cervical ganglion
-- Travel with internal carotid artery to enter the cavernous sinus
-- In the sinus:
  ---- Fibers bound for the pupil join CN6, then V1
  ---- Fibers bound for Mueller’s muscle
  ---- Fibers bound for sweat glands of the forehead hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches

What about fibers bound for the lacrimal gland?
-- Do they pass through the cavernous sinus as well?
-- No
-- These hop off the internal carotid before it enters the sinus, and join the preganglionic parasympathetic fibers on their way to innervate the gland.

These postganglionic sympathetic fibers form a named nerve of their own—what is its name?
-- The deep petrosal nerve
-- The greater petrosal nerve

By what passage does the vidian nerve exit the skull?
The vidian canal

These preganglionic parasympathetic fibers form a named nerve—what is its name?
The greater petrosal nerve

Once the deep petrosal and greater petrosal nerves join up, they form a new named nerve—what is its name?
The vidian nerve aka... the nerve of the vidian canal

By what passage does the vidian nerve exit the skull?
The vidian canal
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in cilio-spinal center of Budge

Second-order neurons aka...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion

Third-order neurons aka...
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
----Fibers bound for the pupil join CN6, then V1
----Fibers bound for Mueller's muscle
----Fibers bound for sweat glands of the forehead hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches

What about fibers bound for the lacrimal gland
do they pass through the cavernous sinus as well?
No
--these hop off the internal carotid before it enters the sinus, and join the preganglionic parasympathetic fibers on their way to innervate the gland

These postganglionic sympathetic fibers form a named nerve of their own -- what is its name?
The deep petrosal nerve

By what passage does the vidian nerve exit the skull?
The vidian canal

These preganglionic parasympathetic fibers form a named nerve -- what is its name?
The vidian nerve aka...the nerve of the vidian canal

The vidian nerve exit the skull?

What is the vidian canal aka...

Where is the vidian nerve headed when it leaves the skull?

The pterygopalatine ganglion

Will the sympathetic fibers synapse in the pterygopalatine ganglion?
No, they are postganglionic, and will pass through the ganglion without synapsing. Only the preganglionic parasympathetics will synapse in the pterygopalatine ganglion.
**Horner Syndrome**

*Neural pathway in Horner syndrome:*
First-order neurons
-- Originate in hypothalamus
-- Travel in spinal cord
-- Synapse in ciliospinal center of Budge

Second-order neurons *aka...pre-ganglionic neurons*
-- Originate at Budge center
-- Exit spinal cord
-- Travel in sympathetic chain
-- Synapse in superior cervical ganglion

Third-order neurons *aka...post-ganglionic neurons*
-- Originate in superior cervical ganglion
-- Travel with internal carotid artery to enter the cavernous sinus
-- In the sinus:
  ---- Fibers bound for the pupil join CN6, then V1
  ---- Fibers bound for Mueller's muscle
  ---- Fibers bound for sweat glands of the forehead hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches

*What about fibers bound for the lacrimal gland?*
-- Do they pass through the cavernous sinus as well?
  No
-- These hop off the internal carotid before it enters the sinus, and join the preganglionic parasympathetic fibers on their way to innervate the gland

*These postganglionic sympathetic fibers form a named nerve of their own--what is its name?*
The deep petrosal nerve

*By what passage does the vidian nerve exit the skull?*
The vidian canal

*These preganglionic parasympathetic fibers form a named nerve--what is its name?*
The greater petrosal nerve

*The vidian nerve aka...the nerve of the vidian canal?

*What is the vidian nerve headed when it leaves the skull?*
The pterygopalatine ganglion

*Will the sympathetic fibers synapse in the pterygopalatine ganglion?*
No, they are postganglionic, and will pass through the ganglion without synapsing.

*Only the preganglionic parasympathetics will synapse in the pterygopalatine ganglion.*
Horizontal pathway in Horner syndrome:
First-order neurons
-- Originate in hypothalamus
-- Travel in spinal cord
-- Synapse in cilio-spinal center of Budge

Second-order neurons aka... pre-ganglionic neurons
-- Originate at Budge center
-- Exit spinal cord
-- Travel in sympathetic chain
-- Synapse in superior cervical ganglion

Third-order neurons aka... post-ganglionic neurons
-- Originate in superior cervical ganglion
-- Travel with internal carotid artery to enter the cavernous sinus
-- In the sinus:
  ---- Fibers bound for the pupil join CN6, then V1
  ---- Fibers bound for Mueller's muscle
  ---- Fibers bound for sweat glands of the forehead hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches

What about fibers bound for the lacrimal gland
-- Do they pass through the cavernous sinus as well?
No
-- These hop off the internal carotid before it enters the sinus, and join the preganglionic parasympathetic fibers on their way to innervate the gland

These postganglionic sympathetic fibers form a named nerve of their own
-- What is its name?
The deep petrosal nerve

Where is the vidian nerve headed when it leaves the skull?
The pterygopalatine ganglion

Will the sympathetic fibers synapse in the pterygopalatine ganglion?
No, they are postganglionic, and will pass through the ganglion without synapsing. Only the preganglionic parasympathetics will synapse in the pterygopalatine ganglion.

By what passage does the vidian nerve exit the skull?
The vidian canal

These preganglionic parasympathetic fibers form a named nerve -- what is its name?
The vidian nerve aka... the nerve of the vidian canal

These preganglionic parasympathetic fibers on their way to innervate the gland form a named nerve -- what is its name?
The greater petrosal nerve
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord
--Synapse in ciliospinal center of Budge

Second-order neurons aka...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion

Third-order neurons aka...post-ganglionic neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
---- Fibers bound for the pupil join CN6, then V1
---- Fibers bound for Mueller's muscle
---- Fibers bound for sweat glands of the forehead hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches

Horner Syndrome aka...pre-ganglionic neurons aka...the stellate ganglion aka...post-ganglionic neurons

What about fibers bound for the lacrimal gland--do they pass through the cavernous sinus as well?
No--these hop off the internal carotid before it enters the sinus, and join the preganglionic parasympathetic fibers on their way to innervate the gland.

These postganglionic sympathetic fibers form a named nerve of their own--what is its name?
The deep petrosal nerve

By what passage does the vidian nerve exit the skull?
The vidian canal

Where is the vidian nerve headed when it leaves the skull?
The pterygopalatine ganglion

Will the sympathetic fibers synapse in the pterygopalatine ganglion?
No, they are postganglionic, and will pass through the ganglion without synapsing. Only the preganglionic parasympathetics will synapse in the pterygopalatine ganglion.

These preganglionic parasympathetic fibers 'belong' to which cranial nerve?
CN7

These preganglionic parasympathetic fibers form a named nerve--what is its name?
The greater petrosal nerve

Once the deep petrosal and greater petrosal nerves join up, they form a new named nerve--what is its name?
The vidian nerve

By what passage does the vidian nerve exit the skull?
The vidian canal

Where is the vidian nerve headed when it leaves the skull?
The pterygopalatine ganglion

Will the sympathetic fibers synapse in the pterygopalatine ganglion?
No, they are postganglionic, and will pass through the ganglion without synapsing. Only the preganglionic parasympathetics will synapse in the pterygopalatine ganglion.
Horner Syndrome

**Neural pathway in Horner syndrome:**

First-order neurons
-- Originate in hypothalamus
-- Travel in spinal cord

Second-order neurons aka...pre-ganglionic neurons
-- Originate at Budge center
-- Exit spinal cord
-- Travel in sympathetic chain
-- Synapse in superior cervical ganglion

Third-order neurons aka...post-ganglionic neurons
-- Originate in superior cervical ganglion
-- Travel with internal carotid artery to enter the cavernous sinus
-- In the sinus:
  ---- Fibers bound for the pupil join CN6, then V1
  ---- Fibers bound for Mueller’s muscle
  ---- Fibers bound for sweat glands of the forehead hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches

**Horner Syndrome**

Horner Syndrome aka...pre-ganglionic neurons aka...the stellate ganglion aka...post-ganglionic neurons

What about fibers bound for the lacrimal gland--do they pass through the cavernous sinus as well?

No--these hop off the internal carotid before it enters the sinus, and join the preganglionic parasympathetic fibers on their way to innervate the gland.

These postganglionic sympathetic fibers form a named nerve of their own--what is its name?

The deep petrosal nerve

Once the deep petrosal and greater petrosal nerves join up, they form a new named nerve--what is its name?

The vidian nerve

By what passage does the vidian nerve exit the skull?

The vidian canal

Where is the vidian nerve headed when it leaves the skull?

The pterygopalatine ganglion

Will the sympathetic fibers synapse in the pterygopalatine ganglion?

No, they are postganglionic, and will pass through the ganglion without synapsing. Only the preganglionic parasympathetics will synapse in the pterygopalatine ganglion.

These preganglionic parasympathetic fibers form a named nerve--what is its name?

The greater petrosal nerve

Finally: How will the postganglionic sympathetics and (now) postganglionic parasympathetics get to the lacrimal gland?

They will pass through the inferior orbital fissure to join the lacrimal nerve on its way to the gland.
Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in spinal cord

**Finally:** How will the postganglionic sympathetics and (now) postganglionic parasympathetics get to the lacrimal gland?
They will pass through the [ ] orbital fissure to join the [ ] nerve on its way to the gland.

Second-order neurons aka...pre-ganglionic neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion

Where is the vidian nerve headed when it leaves the skull?
The pterygopalatine ganglion

Will the sympathetic fibers synapse in the pterygopalatine ganglion?
No, they are postganglionic, and will pass through the ganglion without synapsing. Only the preganglionic parasympathetics will synapse in the pterygopalatine ganglion.

Third-order neurons aka...post-ganglionic neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus
--In the sinus:
----Fibers bound for the pupil join CN6, then V1
----Fibers bound for Mueller's muscle
----Fibers bound for sweat glands of the forehead hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches

What about fibers bound for the lacrimal gland?
do they pass through the cavernous sinus as well?
No--these hop off the internal carotid before it enters the sinus, and join the preganglionic parasympathetic fibers on their way to innervate the gland.

These postganglionic sympathetics form a named nerve of their own--what is its name?
The deep petrosal nerve

By what passage does the **vidian nerve** exit the skull?
The **vidian canal**

The deep petrosal and greater petrosal nerves join up, they form a new named nerve--what is its name?
The **vidian nerve** aka...the nerve of the vidian canal

The greater petrosal nerve

Where is the vidian nerve headed when it leaves the skull?
The pterygopalatine ganglion

Will the sympathetic fibers synapse in the pterygopalatine ganglion?
No, they are postganglionic, and will pass through the ganglion without synapsing. Only the preganglionic parasympathetics will synapse in the pterygopalatine ganglion.

These preganglionic parasympathetic fibers form a named nerve--what is its name?
The deep petrosal nerve

These preganglionic parasympathetic fibers form a named nerve--what is its name?
The greater petrosal nerve

Finally: How will the postganglionic sympathetics and (now) postganglionic parasympathetics get to the lacrimal gland?
They will pass through the [ ] orbital fissure to join the [ ] nerve on its way to the gland.

The deep petrosal nerve

The greater petrosal nerve

The vidian nerve

The vidian canal

The pterygopalatine ganglion

The deep petrosal nerve

The greater petrosal nerve
Neural pathway in Horner syndrome:

First-order neurons
--Originate in hypothalamus
--Travel in spinal cord

Second-order neurons
--Originate at Budge center
--Exit spinal cord
--Travel in sympathetic chain
--Synapse in superior cervical ganglion

Third-order neurons
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the cavernous sinus

These postganglionic sympathetic fibers on their way to innervate the gland
The deep petrosal nerve
The greater petrosal nerve

They will pass through the inferior orbital fissure to join the lacrimal nerve on its way to the gland

Finally: How will the postganglionic sympathetics and (now) postganglionic parasympathetics get to the lacrimal gland?

Where is the vidian nerve headed when it leaves the skull?
The pterygopalatine ganglion

Will the sympathetic fibers synapse in the pterygopalatine ganglion?
No, they are postganglionic, and will pass through the ganglion without synapsing. Only the preganglionic parasympathetics will synapse in the pterygopalatine ganglion.

By what passage does the vidian nerve exit the skull?
The vidian canal

These preganglionic parasympathetic fibers form a named nerve—what is its name?
The vidian nerve
aka...the nerve of the vidian canal

What about fibers bound for the lacrimal gland?
--do they pass through the cavernous sinus as well?
No—these hop off the internal carotid before it enters the sinus, and join the preganglionic parasympathetic fibers on their way to innervate the gland

These preganglionic parasympathetic fibers form a named nerve—what is its name?
The greater petrosal nerve

By what passage does the vidian nerve exit the skull?
The vidian canal

Finally: How will the postganglionic sympathetics and (now) postganglionic parasympathetics get to the lacrimal gland?

They will pass through the inferior orbital fissure to join the lacrimal nerve on its way to the gland
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome:
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

Wallenberg syndrome: Central

What is the noneponymous name for Wallenberg syndrome?
Wallenberg syndrome: **Central**

*What is the noneponymous name for Wallenberg syndrome?*
Lateral medullary syndrome
Wallenberg syndrome: Central

What is the noneponymous name for Wallenberg syndrome?
Lateral medullary syndrome

Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central

  What is the noneponymous name for Wallenberg syndrome?
  Lateral medullary syndrome

  Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?
  Ipsilateral
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

Wallenberg syndrome: Central

What is the noneponymous name for Wallenberg syndrome?
Lateral medullary syndrome

Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?
Ipsilateral

Wallenberg's hallmark symptom is sensory--what is it?
Wallenberg syndrome: **Central**

*What is the noneponymous name for Wallenberg syndrome?*
Lateral medullary syndrome

*Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?*
Ipsilateral

*Wallenberg’s hallmark symptom is sensory--what is it?*
Loss of pain and temperature sensation to the ipsilateral face and contralateral body
Wallenberg syndrome: Central

What is the noneponymous name for Wallenberg syndrome?
Lateral medullary syndrome

Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?
Ipsilateral

Wallenberg’s hallmark symptom is sensory--what is it?
Loss of pain and temperature sensation to the ipsilateral face and contralateral body

Besides the Horner and sensory findings, what are the main signs/symptoms?
--
--
Wallenberg syndrome: Central

What is the noneponymous name for Wallenberg syndrome?
Lateral medullary syndrome

Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?
Ipsilateral

Wallenberg’s hallmark symptom is sensory--what is it?
Loss of pain and temperature sensation to the ipsilateral face and contralateral body

Besides the Horner and sensory findings, what are the main signs/symptoms?
--Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

Wallenberg syndrome: Central

What is the nonpneymous name for Wallenberg syndrome?
Lateral medullary syndrome

Speaking of disequilibrium: Wallenberg pts often c/o feeling like their body is being ‘pulled to one side.’ What is the name for this sensation?
Disequilibrium

Besides the Horner and sensory findings, what are the main signs/symptoms?
--Cerebellar signs: disequilibrium, ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties

Occlusion of what vessel is implicated in Wallenberg syndrome?
The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- **Wallenberg syndrome**: Central
  
  What is the non-eponymous name for Wallenberg syndrome? Lateral medullary syndrome.

  Speaking of disequilibrium: Wallenberg pts often c/o feeling like their body is being ‘pulled to one side.’ What is the name for this sensation? Lateropulsion.

  - Cerebellar symptoms: Disequilibrium, ataxia, nystagmus, skew deviation
  - Speech and swallowing difficulties
  
  What is the ipsilateral or contralateral to the lesion? Ipsilateral.

  Wallenberg’s hallmark symptom is sensory—what is it? Loss of pain and temperature sensation to the ipsilateral face and contralateral body.

  Besides the Horner and sensory findings, what are the main signs/symptoms? Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation. Speech and swallowing difficulties.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

**Wallenberg syndrome:** Central

What is the noneponymous name for Wallenberg syndrome?
Lateral medullary syndrome

Speaking of disequilibrium: Wallenberg pts often c/o feeling like their body is being ‘pulled to one side.’ What is the name for this sensation?
Lateropulsion

In Wallenberg, do pts feel like they are being pulled toward the lesion side, or away from it?
Disequilibrium

---
"Disequilibrium": Wallenberg pts often c/o feeling like their body is being ‘pulled to one side.’ What is the name for this sensation?
Lateropulsion

In Wallenberg, do pts feel like their being pulled toward the lesion side, or away from it?
Disequilibrium

---
What is the noneponymous name for Wallenberg syndrome?
Lateral medullary syndrome

What is the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated?

---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---
---

For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

Wallenberg syndrome: **Central**

- What is the noneponymous name for Wallenberg syndrome? Lateral medullary syndrome

Speaking of disequilibrium: Wallenberg pts often c/o feeling like their body is being ‘pulled to one side.’ What is the name for this sensation? Lateropulsion

In Wallenberg, do pts feel like their being pulled toward the lesion side, or away from it? Toward it

--Cerebellar signs: disequilibrium, ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

**Wallenberg syndrome:** Central

- **What is the noneponymous name for Wallenberg syndrome?**
  Lateral medullary syndrome

- **Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?**
  - Lateral gaze movements toward the lesion side are notably faster than are lateral movements toward the contralateral side.
  - During vertical saccades, the eyes will move toward the lesion side.
  - When the pt is not fixating a visual target (eg, during eye closure), the eyes will move into lateral gaze toward the lesion side.

- **In Wallenberg, do pts feel like their body is being ‘pulled’ toward the lesion side or away from it?**
  Toward it

- **Speaking of disequilibrium: Wallenberg pts often manifest something called disequilibrium. What are the symptoms?**
  - Cerebellar signs: ataxia, nystagmus, skew deviation.
  - Speech and swallowing difficulties.
What is the non-eponymous name for Wallenberg syndrome?
Lateral medullary syndrome

What is the hallmark symptom of Wallenberg syndrome?
Loss of pain and temperature sensation to the ipsilateral face and contralateral body

Besides the Horner and sensory findings, what else are the main signs/symptoms?
Cerebellar signs: disequilibrium, ataxia, nystagmus, skew deviation
Speech and swallowing difficulties

Occlusion of what vessel is implicated in Wallenberg syndrome?
The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery

Speaking of disequilibrium: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side
--- during vertical saccades, the eyes will move toward the lesion side
--- when the pt is not fixating a visual target (eg, during eye closure), the eyes will move into lateral gaze toward the lesion side slower vs faster

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it

--- Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--- Lateral-gaze movements toward the lesion side are notably slower than are lateral movements toward the contralateral side

--- In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from the lesion side?
Toward it
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: **Central**

  What is the noneponymous name for Wallenberg syndrome?
  Lateral medullary syndrome.

  **Speaking of lateropulsion:** Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
  --Lateral-gaze movements toward the lesion side are notably faster than are lateral movements toward the contralateral side.
  --
  --

  Speaking of disequilibrium: Wallenberg pts often feel like their body is being ‘pulled’ to one side. What is the name for this sensation?
  Lateropulsion.

  In Wallenberg, do pts feel like their body is being pulled toward or away from it?
  Toward it.

  What are the main signs/symptoms of Wallenberg syndrome?
  --Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation.
  --Speech and swallowing difficulties.

  Occlusion of what vessel is implicated in Wallenberg syndrome?
  The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- **Wallenberg syndrome:** Central

  What is the noneponymous name for Wallenberg syndrome? 
  Lateral medullary syndrome

  Speaking of disequilibrium: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition? 
  -- Lateral-gaze movements toward the lesion side are notably faster than are lateral movements toward the contralateral side. 
  -- During vertical saccades, the eyes will move toward the lesion side. 
  -- When the pt is not fixating a visual target (e.g., during eye closure), the eyes will move into lateral gaze toward the lesion side.

  In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from it? Toward it.

  Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition? 
  -- Lateral-gaze movements toward the lesion side are notably faster than are lateral movements toward the contralateral side. 
  -- During vertical saccades, the eyes will move toward the lesion side.

  -- When the pt is not fixating a visual target (e.g., during eye closure), the eyes will move into lateral gaze toward the lesion side.

  In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from it? Toward it.

  Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition? 
  -- Lateral-gaze movements toward the lesion side are notably faster than are lateral movements toward the contralateral side. 
  -- During vertical saccades, the eyes will move toward the lesion side.

  -- When the pt is not fixating a visual target (e.g., during eye closure), the eyes will move into lateral gaze toward the lesion side.

  In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from it? Toward it.

  Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition? 
  -- Lateral-gaze movements toward the lesion side are notably faster than are lateral movements toward the contralateral side. 
  -- During vertical saccades, the eyes will move toward the lesion side.

  -- When the pt is not fixating a visual target (e.g., during eye closure), the eyes will move into lateral gaze toward the lesion side.

  In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from it? Toward it.

  Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition? 
  -- Lateral-gaze movements toward the lesion side are notably faster than are lateral movements toward the contralateral side. 
  -- During vertical saccades, the eyes will move toward the lesion side.

  -- When the pt is not fixating a visual target (e.g., during eye closure), the eyes will move into lateral gaze toward the lesion side.

  In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from it? Toward it.

  Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition? 
  -- Lateral-gaze movements toward the lesion side are notably faster than are lateral movements toward the contralateral side. 
  -- During vertical saccades, the eyes will move toward the lesion side.

  -- When the pt is not fixating a visual target (e.g., during eye closure), the eyes will move into lateral gaze toward the lesion side.

  In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from it? Toward it.

  Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition? 
  -- Lateral-gaze movements toward the lesion side are notably faster than are lateral movements toward the contralateral side. 
  -- During vertical saccades, the eyes will move toward the lesion side.

  -- When the pt is not fixating a visual target (e.g., during eye closure), the eyes will move into lateral gaze toward the lesion side.

  In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from it? Toward it.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- **Wallenberg syndrome:** Central

**What is the noneponymous name for Wallenberg syndrome?**
Lateral medullary syndrome

**Speaking of lateropulsion:** Wallenberg pts often manifest something called **ocular lateropulsion.** What are the findings in this condition?
---
- Lateral-gaze movements toward the lesion side are notably faster than are lateral movements toward the contralateral side.
- During vertical saccades, the eyes will move toward the lesion side.

**In Wallenberg, do pts feel like their body is being ‘pulled’ toward or away from it?**
Toward it

**Cerebellar signs:** Disequilibrium, ataxia, nystagmus, skew deviation

**Speech and swallowing difficulties:**

Speaking of disequilibrium: Wallenberg pts often manifest something called lateropulsion. What are the findings in this condition?
Wallenberg syndrome: Central

What is the noneponymous name for Wallenberg syndrome? Lateral medullary syndrome

Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?
--Lateral-gaze movements toward the lesion side are notably faster than are lateral movements toward the contralateral side
--During vertical saccades, the eyes will move toward the lesion side
--When the pt is not fixating a visual target (eg, during eye closure), the eyes will move into lateral gaze toward the lesion side

In Wallenberg, do pts feel like their body is being 'pulled' or away from it? Toward it

Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation

Speech and swallowing difficulties
Wallenberg syndrome: Central

*What is the noneponymous name for Wallenberg syndrome?*  
Lateral medullary syndrome

*Speaking of lateropulsion: Wallenberg pts often manifest something called ocular lateropulsion. What are the findings in this condition?*  
- Lateral-gaze movements toward the lesion side are notably faster than are lateral movements toward the contralateral side  
- During vertical saccades, the eyes will move toward the lesion side  
- When the pt is not fixating a visual target (eg, during eye closure), the eyes will move into lateral gaze toward the lesion side

*Speaking of disequilibrium: Wallenberg pts often manifest something called disequilibrium. What are the findings in this condition?*  
- Cerebellar signs: Ataxia, nystagmus, skew deviation  
- Speech and swallowing difficulties

*In Wallenberg, do pts feel like their body is being ‘pulled’ or away from it?*  
Toward it
What is the noneponymous name for Wallenberg syndrome?
Lateral medullary syndrome

Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?
Ipsilateral

Wallenberg’s hallmark symptom is sensory--what is it?
Loss of pain and temperature sensation to the ipsilateral face and contralateral body

Besides the Horner and sensory findings, what are the main signs/symptoms?
-- Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation
-- Speech and swallowing difficulties

Occlusion of what vessel is implicated in Wallenberg syndrome?
The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery

Wallenberg syndrome is a form of CVA. In that regard: What very common sign/symptom of a CVA is not listed here, ie, is not a component of Wallenberg's?
Paralysis

Why no paralysis in Wallenberg's?
As in real estate, the three most important factors in CVA are location, location, and location. And with respect to CVA location, the general rule is, events that affect the lateral brainstem cause sensory, not paralysis (aka “stroke without paralysis”).

For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated
What is the noneponymous name for Wallenberg syndrome?
Lateral medullary syndrome

Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?
Ipsilateral

Wallenberg’s hallmark symptom is sensory--what is it?
Loss of pain and temperature sensation

Besides the Horner and sensory findings, what are the main signs/symptoms?
- Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation
- Speech and swallowing difficulties

Occlusion of what vessel is implicated in Wallenberg syndrome?
The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery

Wallenberg syndrome is a form of CVA. In that regard: What very common sign/symptom of a CVA is not listed here, ie, is not a component of Wallenberg’s?
Paralysis

As in real estate, the three most important factors in CVA are location, location, and location. And with respect to CVA location, the general rule is, events that affect the lateral brainstem cause sensory, not paralysis (aka “stroke without paralysis”).
What is the non-eponymous name for Wallenberg syndrome? Lateral medullary syndrome

Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion? Ipsilateral

Wallenberg’s hallmark symptom is sensory--what is it? Loss of pain and temperature sensation to the ipsilateral face and contralateral body

Besides the Horner and sensory findings, what are the main signs/symptoms?
- Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation
- Speech and swallowing difficulties

Occlusion of what vessel is implicated in Wallenberg syndrome? The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery

Wallenberg syndrome is a form of CVA. In that regard:
What very common sign/symptom of a CVA is not listed here, ie, is not a component of Wallenberg's? Paralysis

Why no paralysis in Wallenberg’s?
As in real estate, the three most important factors in CVA are location, location, and location. And with respect to CVA location, the general rule is, events that affect the lateral brainstem cause sensory loss, not paralysis (aka “stroke without paralysis”).
What is the nonenonymous name for Wallenberg syndrome?
Lateral medullary syndrome

Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?
Ipsilateral

Wallenberg’s hallmark symptom is sensory--what is it?
Loss of pain and temperature sensation to the ipsilateral face and contralateral body

Besides the Horner and sensory findings, what are the main signs/symptoms?
- Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation
- Speech and swallowing difficulties

Occlusion of what vessel is implicated in Wallenberg syndrome?
The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery

Wallenberg syndrome is a form of CVA. In that regard:
What very common sign/symptom of a CVA is not listed here, ie, is not a component of Wallenberg’s?
Paralysis

Why no paralysis in Wallenberg’s?
As in real estate, the three most important factors in CVA are location, location, and location.
And with respect to CVA location, the general rule is, events that affect the lateral brainstem cause sensory loss, not paralysis (aka “stroke without paralysis”).
Wallenberg syndrome: **Central**

*What is the noneponymous name for Wallenberg syndrome?*
Lateral medullary syndrome

*Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?*
Ipsilateral

Wallenberg’s hallmark symptom is sensory—what is it?
Loss of pain and temperature sensation to the ipsilateral face and contralateral body

Besides the Horner and sensory findings, what are the main signs/symptoms?

--- **Cerebellar signs**: Disequilibrium, ataxia, nystagmus, skew deviation
--- **Speech and swallowing difficulties**

*Occlusion of what vessel is implicated in Wallenberg syndrome?*
The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery

--- **Wallenberg syndrome is a form of CVA. In that regard:**
*What very common sign/symptom of a CVA is **not** listed here, ie, is not a component of Wallenberg's?***
Paralysis

*Why no paralysis in Wallenberg's?*
As in real estate, the three most important factors in CVA are location, location, and location.
Wallenberg syndrome: Central

What is the noneponymous name for Wallenberg syndrome?
Lateral medullary syndrome

Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?
Ipsilateral

Wallenberg's hallmark symptom is sensory--what is it?
Loss of pain and temperature sensation to the ipsilateral face and contralateral body

Besides the Horner and sensory findings, what else?
- **Cerebellar signs**: Disequilibrium, ataxia, nystagmus, skew deviation
- **Speech and swallowing difficulties**

Occlusion of what vessel is implicated in Wallenberg syndrome?
The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery

Wallenberg syndrome is a form of CVA. In that regard: What very common sign/symptom of a CVA is **not** listed here, ie, is not a component of Wallenberg's?
Paralysis

Why no paralysis in Wallenberg's?
As in real estate, the three most important factors in CVA are location, location, and location. And with respect to CVA location, the general rule is, events that affect the lateral brainstem cause sensory loss, not paralysis (aka “stroke without paralysis”).
What is the non-eponymous name for Wallenberg syndrome?
**Lateral medullary syndrome**

Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?
Ipsilateral

Wallenberg’s hallmark symptom is sensory—what is it?
Loss of pain and temperature sensation to the ipsilateral face and contralateral body

Besides the Horner and sensory findings, what else?
--- **Cerebellar signs**: Disequilibrium, ataxia, nystagmus
--- **Speech and swallowing difficulties**

Occlusion of what vessel is implicated in Wallenberg syndrome?
The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery

Wallenberg syndrome is a form of CVA. In that regard:
What very common sign/symptom of a CVA is **not** listed here, ie, is not a component of Wallenberg’s?
**Paralysis**

Why no paralysis in Wallenberg’s?
As in real estate, the three most important factors in CVA are location, location, and location. And with respect to CVA location, the general rule is, events that affect the lateral brainstem cause sensory loss, not paralysis (aka “stroke without paralysis”).
Wallenberg syndrome: **Central**

*What is the noneponymous name for Wallenberg syndrome?*
Lateral medullary syndrome

*Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?*
Ipsilateral

*Wallenberg’s hallmark symptom is sensory--what is it?*
Loss of pain and temperature sensation to the ipsilateral face and contralateral body

*Besides the Horner and sensory findings, what are the main signs/symptoms?*
--Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties

*Oclusion of what vessel is implicated in Wallenberg syndrome?*
Wallenberg syndrome: **Central**

- **What is the noneponymous name for Wallenberg syndrome?**
  Lateral medullary syndrome

- **Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?**
  Ipsilateral

- **Wallenberg’s hallmark symptom is sensory—what is it?**
  Loss of pain and temperature sensation to the ipsilateral face and contralateral body

- **Besides the Horner and sensory findings, what are the main signs/symptoms?**
  --Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation
  --Speech and swallowing difficulties

- **Occlusion of what vessel is implicated in Wallenberg syndrome?**
  The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery
Wallenberg syndrome: Central

What is the noneponymous name for Wallenberg syndrome?
Lateral medullary syndrome

Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?
Ipsilateral

Wallenberg’s hallmark symptom is sensory—what is it?
Loss of pain and temperature sensation to the ipsilateral face and contralateral body

Besides the Horner and sensory findings, what are the main signs/symptoms?
--Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties

Occlusion of what vessel is implicated in Wallenberg syndrome?
The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery

What mechanism is typically responsible for occluding the vessel in:
--An older vasculopath?
--A young adult?
--A pt with valvular dz, or arrythmia?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- **Wallenberg syndrome**: Central

  - **What is the noneponymous name for Wallenberg syndrome?**
    - Lateral medullary syndrome

  - **Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?**
    - Ipsilateral

  - **Wallenberg’s hallmark symptom is sensory—what is it?**
    - Loss of pain and temperature sensation to the ipsilateral face and contralateral body

  - **Besides the Horner and sensory findings, what are the main signs/symptoms?**
    - Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation
    - Speech and swallowing difficulties

  - **Occlusion of what vessel is implicated in Wallenberg syndrome?**
    - The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery

  - **What mechanism is typically responsible for occluding the vessel in:**
    - An older vasculopathy? Atherosclerosis
    - A young adult? A pt with valvular dz, or arrythmia?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- **Wallenberg syndrome:** Central

  What is the noneponymous name for Wallenberg syndrome?
  Lateral medullary syndrome

  Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?
  Ipsilateral

  Wallenberg’s hallmark symptom is sensory—what is it?
  Loss of pain and temperature sensation to the ipsilateral face and contralateral body

  Besides the Horner and sensory findings, what are the main signs/symptoms?
  --Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation
  --Speech and swallowing difficulties

  Occlusion of what vessel is implicated in Wallenberg syndrome?
  The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery

  What mechanism is typically responsible for occluding the vessel in:
  --An older vasculopath? Atherosclerosis
  --A young adult? A pt with valvular dz, or arrythmia?
Wallenberg syndrome: **Central**

**What is the noneponymous name for Wallenberg syndrome?**
Lateral medullary syndrome

**Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?**
Ipsilateral

**Wallenberg’s hallmark symptom is sensory—what is it?**
Loss of pain and temperature sensation to the ipsilateral face and contralateral body

**Besides the Horner and sensory findings, what are the main signs/symptoms?**
--Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties

**Occlusion of what vessel is implicated in Wallenberg syndrome?**
The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery

**What mechanism is typically responsible for occluding the vessel in:**
--An older vasculopathy? Atherosclerosis
--A young adult? Dissection
--A pt with valvular dz, or arrythmia?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

**Wallenberg syndrome:** Central

**What is the non-eponymous name for Wallenberg syndrome?**
Lateral medullary syndrome

**Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?**
Ipsilateral

Wallenberg’s hallmark symptom is sensory—what is it?
Loss of pain and temperature sensation to the ipsilateral face and contralateral body

**Besides the Horner and sensory findings, what are the main signs/symptoms?**
Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation
Speech and swallowing difficulties

**Occlusion of what vessel is implicated in Wallenberg syndrome?**
The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery

**What mechanism is typically responsible for occluding the vessel in:**
-- An older vasculopath? Atherosclerosis
-- A young adult? Dissection
-- A pt with valvular dz, or arrythmia?
Wallenberg syndrome: **Central**

What is the noneponymous name for Wallenberg syndrome?
Lateral medullary syndrome

Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?
Ipsilateral

Wallenberg’s hallmark symptom is sensory—what is it?
Loss of pain and temperature sensation to the ipsilateral face and contralateral body

Besides the Horner and sensory findings, what are the main signs/symptoms?
--Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties

Occlusion of what vessel is implicated in Wallenberg syndrome?
The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery

What mechanism is typically responsible for occluding the vessel in:
--An older vasculopath? Atherosclerosis
--A young adult? Dissection
--A pt with valvular dz, or arrythmia? Embolism
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

Wallenberg syndrome: Central

Does Wallenberg carry a good, or poor prognosis?

Lateral medullary syndrome

Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?
Ipsilateral

Wallenberg’s hallmark symptom is sensory--what is it?
Loss of pain and temperature sensation to the ipsilateral face and contralateral body

Besides the Horner and sensory findings, what are the main signs/symptoms?
--Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties

Occlusion of what vessel is implicated in Wallenberg syndrome?
The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery
Wallenberg syndrome:** Central

**Does Wallenberg carry a good, or poor prognosis?**
Good--most pts recover with minimal sequelae

**Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?**
Ipsilateral

**Wallenberg’s hallmark symptom is sensory--what is it?**
Loss of pain and temperature sensation to the ipsilateral face and contralateral body

**Besides the Horner and sensory findings, what are the main signs/symptoms?**
--Cerebellar signs: Disequilibrium, ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties

**Occlusion of what vessel is implicated in Wallenberg syndrome?**
The ipsilateral vertebral or (less commonly) posterior inferior cerebellar artery
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma:
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic

In an adult with a pre-ganglionic Horner’s and no history of trauma or surgery, what process should be suspected?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- **Wallenberg syndrome**: Central
- **Neck trauma**: Pre- or post-ganglionic

In an adult with a pre-ganglionic Horner’s and no history of trauma or surgery, what process should be suspected?

An intrathoracic malignancy
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma:
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: **Central**
- Neck trauma: **Pre- or post-ganglionic**
- Neuroblastoma: **Pre-ganglionic**
- Internal carotid dissection:
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner?

About 60%
Wallenberg syndrome: Central
Neck trauma: Pre- or post-ganglionic
Neuroblastoma: Pre-ganglionic
Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner?
About 60%
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner?
About 60

What systemic conditions predispose to carotid-artery dissection?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner?
About 60

What systemic conditions predispose to carotid-artery dissection?
Connective-tissue disorders; eg, Marfan’s and Ehler-Danlos
- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic

**What percent of carotid-artery dissection pts will present with a Horner?**
About 60

**What systemic conditions predispose to carotid-artery dissection?**
Connective-tissue disorders; eg, Marfan’s and Ehler-Danlos

**Is carotid-artery dissection always associated with trauma?**
• Wallenberg syndrome: Central
• Neck trauma: Pre- or post-ganglionic
• Neuroblastoma: Pre-ganglionic
• Internal carotid dissection: Post-ganglionic

For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

What percent of carotid-artery dissection pts will present with a Horner? About 60

What systemic conditions predispose to carotid-artery dissection? Connective-tissue disorders; eg, Marfan’s and Ehler-Danlos

Is carotid-artery dissection always associated with trauma? No, it can occur spontaneously
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner? About 60

What systemic conditions predispose to carotid-artery dissection? Connective-tissue disorders; eg, Marfan’s and Ehler-Danlos

Is carotid-artery dissection always associated with trauma? No, it can occur spontaneously

Name a classic cause of ‘iatrogenic’ (I’m using the term loosely here) carotid-artery dissection:
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner? About 60

What systemic conditions predispose to carotid-artery dissection? Connective-tissue disorders; eg, Marfan’s and Ehler-Danlos

Is carotid-artery dissection always associated with trauma? No, it can occur spontaneously

Name a classic cause of ‘iatrogenic’ (I’m using the term loosely here) carotid-artery dissection: Cervical-spine manipulation by a chiropractor
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner? About 60

What systemic conditions predispose to carotid-artery dissection?
Connective tissue disorders; eg, Marfan’s and Ehler-Danlos

Is carotid-artery dissection always associated with trauma? No, it can occur spontaneously

Name a classic cause of ‘iatrogenic’ (I’m using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

If carotid dissection is suspected, what is the first step in management?
Emergent neuroimaging

What imaging study should be ordered?
Angiography — either CTA or MRA

What about carotid doppler study — wouldn’t that suffice? No, it is not adequate
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner?
About 60%

What systemic conditions predispose to carotid-artery dissection?
Connective tissue disorders; eg, Marfan’s and Ehler-Danlos

Is carotid-artery dissection always associated with trauma?
No, it can occur spontaneously

Name a classic cause of 'iatrogenic' (I’m using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

If carotid dissection is suspected, what is the first step in management?
Emergent neuroimaging

What imaging study should be ordered?
Angiography -- either CTA or MRA

What about carotid doppler study -- wouldn't that suffice?
No, it is not adequate
Wallenberg syndrome: Central
Neck trauma: Pre- or post-ganglionic
Neuroblastoma: Pre-ganglionic
Internal carotid dissection: Post-ganglionic

For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

What percent of carotid-artery dissection pts will present with a Horner? About 60

What systemic conditions predispose to carotid-artery dissection?
Connective-tissue disorders; eg, Marfan's and Ehler-Danlos

Is carotid-artery dissection always associated with trauma?
No, it can occur spontaneously

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

If carotid dissection is suspected, what is the first step in management?
Emergent neuroimaging

What imaging study should be ordered? Angiography -- either CTA or MRA

What about carotid doppler study -- wouldn't that suffice?
No, it is not adequate
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner? About 60

What systemic conditions predispose to carotid-artery dissection? Connective-tissue disorders; e.g., Marfan’s and Ehler-Danlos

Is carotid-artery dissection always associated with trauma? No, it can occur spontaneously

Name a classic cause of ‘iatrogenic’ (I'm using the term loosely here) carotid-artery dissection: Cervical-spine manipulation by a chiropractor

If carotid dissection is suspected, what is the first step in management? Emergent neuroimaging

What imaging study should be ordered? Angiography--either CTA or MRA

Cervical-spine manipulation by a chiropractor
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner?
About 60

What systemic conditions predispose to carotid-artery dissection?
Connective-tissue disorders; eg, Marfan’s and Ehler-Danlos

Is carotid-artery dissection always associated with trauma?
No, it can occur spontaneously

Name a classic cause of ‘iatrogenic’ (I’m using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

If carotid dissection is suspected, what is the first step in management?
Emergent neuroimaging

What imaging study should be ordered?
Angiography—either CTA or MRA

What about carotid doppler study—wouldn’t that suffice?
No, it is not adequate
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner?
About 60%

What systemic conditions predispose to carotid-artery dissection?
Connective tissue disorders; e.g., Marfan's and Ehlers-Danlos

Is carotid-artery dissection always associated with trauma?
No, it can occur spontaneously

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

If carotid dissection is suspected, what is the first step in management?
Emergent neuroimaging

What imaging study should be ordered?
Angiography--either CTA or MRA

What about carotid doppler study--wouldn't that suffice?
No, it is not adequate
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner? About 60

What systemic conditions predispose to carotid-artery dissection? Connective-tissue disorders; eg, Marfan's and Ehler-Danlos

Is carotid-artery dissection always associated with trauma? No, it can occur spontaneously

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection: Cervical-spine manipulation by a chiropractor

If carotid dissection is suspected, what is the first step in management? Emergent neuroimaging

What imaging study should be ordered? Angiography—either CTA or MRA

What about carotid doppler study—wouldn’t that suffice? No, it is not adequate

Imaging must extend from where to where; ie, what anatomic structures delimit the region that needs to be imaged?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner?
About 60

What systemic conditions predispose to carotid-artery dissection?
Connective-tissue disorders; eg, Marfan’s and Ehler-Danlos

Is carotid-artery dissection always associated with trauma?
No, it can occur spontaneously

Name a classic cause of ‘iatrogenic’ (I’m using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

If carotid dissection is suspected, what is the first step in management?
Emergent neuroimaging

What imaging study should be ordered?
Angiography—either CTA or MRA

What about carotid doppler study—wouldn’t that suffice?
No, it is not adequate

Imaging must extend from where to where; ie, what anatomic structures delimit the region that needs to be imaged?
It must extend from the apex of the lung up to the Circle of Willis
Wallenberg syndrome: Central
Neck trauma: Pre- or post-ganglionic
Neuroblastoma: Pre-ganglionic
Internal carotid dissection: Post-ganglionic
Pancoast tumor:
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
Wallenberg syndrome: Central
Neck trauma: Pre- or post-ganglionic
Neuroblastoma: Pre-ganglionic
Internal carotid dissection: Post-ganglionic
Pancoast tumor: Pre-ganglionic

What is a Pancoast tumor?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- **Pancoast tumor**: Pre-ganglionic

*What is a Pancoast tumor?*
A mass at or near the superior sulcus (=apex) of the lung.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: HA = ‘Headache’ (but we’ll also use it to mean something else a few slides hence)
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic

Is Horner syndrome a common finding in cluster HA?

Yes -- estimates run as high as 50%

So, Horner’s + HA cinches a diagnosis of cluster HA, then?

No! Dissection of the internal carotid artery is also associated with HA, face and/or eye pain.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic

Is Horner syndrome a common finding in cluster HA? Yes--estimates run as high as 50%
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic

Is Horner syndrome a common finding in cluster HA?
Yes--estimates run as high as 50%

So, Horner’s + HA cinches a diagnosis of cluster HA, then?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic

Is Horner syndrome a common finding in cluster HA?
Yes—estimates run as high as 50%

So, Horner’s + HA cinches a diagnosis of cluster HA, then? No! Dissection of the internal carotid artery is also associated with HA, face and/or eye pain.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic

Is Horner syndrome a common finding in cluster HA?
Yes--estimates run as high as 50%

So, Horner’s + HA cinches a diagnosis of cluster HA, then? No! Dissection of the internal carotid artery is also associated with HA, face and/or eye pain

Acute-onset Horner’s + facial/neck pain is an internal carotid dissection until proven otherwise, and must be worked up emergently!
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery:
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic
Wallenberg syndrome: Central
Neck trauma: Pre- or post-ganglionic
Neuroblastoma: Pre-ganglionic
Internal carotid dissection: Post-ganglionic
Pancoast tumor: Pre-ganglionic
Cluster HA: Post-ganglionic
Forceps delivery: Pre- or post-ganglionic

How does one ‘prove’ a patient has a Horner’s?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

How does one ‘prove’ a patient has a Horner’s?

Cocaine drop testing. Cocaine will essentially eliminate anisocoria if and only if the sympathetic chain is intact.
Wallenberg syndrome: Central
Neck trauma: Pre- or post-ganglionic
Neuroblastoma: Pre-ganglionic
Internal carotid dissection: Post-ganglionic
Pancoast tumor: Pre-ganglionic
Cluster HA: Post-ganglionic
Forceps delivery: Pre- or post-ganglionic

How does one ‘prove’ a patient has a Horners?
Cocaine drop testing. **Cocaine will essentially eliminate anisocoria if and only if the sympathetic chain is intact.**

Why is this? That is, what is it about cocaine drops that allows this assertion to be made?
How does one ‘prove’ a patient has a Horner’s?
Cocaine drop testing. Cocaine will essentially eliminate anisocoria if and only if the sympathetic chain is intact.

Why is this? That is, what is it about cocaine drops that allows this assertion to be made?
Cocaine’s mechanism of action is to block the re-uptake of norepinephrine. Thus, it can dilate the pupil only if norepinephrine is already present in the neuromuscular junctions of the pupillary dilator muscle. And norepinephrine will be present in the junctions only if the post-ganglionic fibers are being prompted to release it by an intact sympathetic chain. Dysfunction anywhere in the chain will result in the absence of norepinephrine in the neuromuscular junction, and therefore a positive (i.e., a failure to dilate) cocaine test.
How does one ‘prove’ a patient has a Horners?

**Cocaine drop testing.** Cocaine will essentially eliminate anisocoria *if and only if* the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horner's?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

How does one ‘prove’ a patient has a Horners?
**Cocaine drop testing.** Cocaine will essentially eliminate anisocoria if and only if the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horners?
**Hydroxyamphetamine (HA) drop testing.** HA drops will eliminate anisocoria if the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horners.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic

How does one 'prove' a patient has a Horner's syndrome?

Cocaine drop testing. Cocaine will essentially eliminate anisocoria if and only if the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horner's?

Hydroxyamphetamine (HA) drop testing. HA drops will eliminate anisocoria if the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horner's.

And why is this? That is, what is it about HA drops that allows this assertion to be made?

HA's mechanism of action is to stimulate the postganglionic fibers to release norepinephrine into the neuromuscular junction. Thus, HA can dilate the pupil only if norepinephrine is in fact present in these bulbs. And norepinephrine will be present in these bulbs only if the post-ganglionic fibers are healthy—if these neurons are damaged—i.e., if the pt has a post-ganglionic Horner's— the degenerated terminal bulbs will have little or no norepinephrine to release, and thus the pupil will dilate poorly or not at all in response to HA. On the other hand, in a central or pre-ganglionic Horner's, the post-ganglionic fibers are intact, and therefore capable of releasing norepinephrine when stimulated to do so by HA.

Why must cocaine drop testing precede HA drop testing?

HA drops cannot distinguish between a preganglionic/central Horner's and a non-Horner eye—the postganglionic fibers are intact for both, so both will dilate in response to HA. Thus, before HA testing is performed, the cocaine test is needed to establish that a Horner's is present.
A

For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic

And why is this? That is, what is it about HA drops that allows this assertion to be made?

HA’s mechanism of action is to stimulate the postganglionic fibers to release norepinephrine into the neuromuscular junction. Thus, HA can dilate the pupil only if norepinephrine is in fact present in these bulbs. And norepinephrine will be present in these bulbs only if the post-ganglionic fibers are healthy. If these neurons are damaged—ie, if the pt has a post-ganglionic Horner syndrome—the degenerated terminal bulbs will have little or no norepinephrine to release, and thus the pupil will dilate poorly or not at all in response to HA. On the other hand, in a central or pre-ganglionic Horners, the post-ganglionic fibers are intact, and therefore capable of releasing norepinephrine when stimulated to do so by HA.

How does one differentiate between a pre- and post-ganglionic Horners?

Hydroxyamphetamine (HA) drop testing. HA drops will eliminate anisocoria if the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horners.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic

And why is this? That is, what is it about HA drops that allows this assertion to be made?

HA’s mechanism of action is to stimulate the postganglionic fibers to release norepinephrine into the neuromuscular junction. Thus, HA can dilate the pupil only if norepinephrine is in fact present in these bulbs. And norepinephrine will be present in these bulbs only if the post-ganglionic fibers are healthy. If these neurons are damaged—ie, if the pt has a post-ganglionic Horner syndrome—the degenerated terminal bulbs will have little or no norepinephrine to release, and thus the pupil will dilate poorly or not at all in response to HA. On the other hand, in a central or pre-ganglionic Horner’s, the post-ganglionic fibers are intact, and therefore capable of releasing norepinephrine when stimulated to do so by HA.

Why must cocaine drop testing precede HA drop testing?

How does one differentiate between a pre- and post-ganglionic Horner’s?

Hydroxyamphetamine (HA) drop testing. HA drops will eliminate anisocoria if the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horner’s.
<table>
<thead>
<tr>
<th>Condition</th>
<th>Type of Horner Syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wallenberg syndrome</td>
<td>Central</td>
</tr>
<tr>
<td>Neck trauma</td>
<td>Pre- or post-ganglionic</td>
</tr>
<tr>
<td>Neuroblastoma</td>
<td>Pre-ganglionic</td>
</tr>
</tbody>
</table>

And why is this? That is, what is it about HA drops that allows this assertion to be made? HA’s mechanism of action is to stimulate the postganglionic fibers to release norepinephrine into the neuromuscular junction. Thus, HA can dilate the pupil only if norepinephrine is in fact present in these bulbs. And norepinephrine will be present in these bulbs only if the post-ganglionic fibers are healthy. If these neurons are damaged—ie, if the pt has a post-ganglionic Horner syndrome—the degenerated terminal bulbs will have little or no norepinephrine to release, and thus the pupil will dilate poorly or not at all in response to HA. On the other hand, in a central or pre-ganglionic Horners, the post-ganglionic fibers are intact, and therefore capable of releasing norepinephrine when stimulated to do so by HA.

Why must cocaine drop testing precede HA drop testing? HA drops cannot distinguish between a preganglionic/central Horner syndrome and a non-Horner eye—the postganglionic fibers are intact for both, so both will dilate in response to HA. Thus, before HA testing is performed, the cocaine test is needed to establish that a Horner syndrome is present.

How does one differentiate between a pre- and post-ganglionic Horners? Hydroxyamphetamine (HA) drop testing. HA drops will eliminate anisocoria if the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horners (assuming cocaine testing has established that a Horner syndrome is present).
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

How does one ‘prove’ a patient has a Horner’s?

**Cocaine drop testing.** Cocaine will essentially eliminate anisocoria if and only if the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horner’s?

**Hydroxyamphetamine (HA) drop testing.** HA drops will eliminate anisocoria if the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horner’s.

What is the brand name for HA drops?

Paradrine
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

How does one ‘prove’ a patient has a Horner’s?

**Cocaine drop testing.** Cocaine will essentially eliminate anisocoria if and only if the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horner’s?

**Hydroxyamphetamine (HA) drop testing.** HA drops will eliminate anisocoria if the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horner’s.

What is the brand name for HA drops?

**Paredrine**
Wallenberg syndrome: Central
Neck trauma: Pre- or post-ganglionic
Neuroblastoma: Pre-ganglionic
Internal carotid dissection: Post-ganglionic
Pancoast tumor: Pre-ganglionic
Cluster HA: Post-ganglionic
Forceps delivery: Pre- or post-ganglionic

Why will HA drop testing be non-localizing if the Horner syndrome is secondary to a history of neck trauma from forceps delivery?

For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

How does one ‘prove’ a patient has a Horner’s?
Cocaine drop testing. Cocaine will essentially eliminate anisocoria if and only if the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horner’s?
Hydroxyamphetamine (HA) drop testing. HA drops will eliminate anisocoria if the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horner’s.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic

**Why will HA drop testing be non-localizing if the Horner syndrome is secondary to a history of neck trauma from forceps delivery?**

Transynaptic degeneration. Pre-ganglionic fiber loss prior to age 10 years leads to transynaptic degeneration of the post-ganglionic fibers. Because of this, the HA response would be negative for a pre- or post-ganglionic lesion originating with a forceps injury. After age 10 years, loss of the pre-ganglionic fibers does not result in transynaptic loss, thus preserving the HA response.

**Forceps delivery: Pre- or post-ganglionic**

How does one ‘prove’ a patient has a Horner’s?

Cocaine drop testing. Cocaine will essentially eliminate anisocoria if and only if the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horner’s?

Hydroxyamphetamine (HA) drop testing. HA drops will eliminate anisocoria if the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horner’s.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic

Why will HA drop testing be non-localizing if the Horner syndrome is secondary to a history of neck trauma from forceps delivery?

What implications does this hold for managing Horner syndrome in children?

For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.
Wallenberg syndrome: Central
Neck trauma: Pre- or post-ganglionic
Neuroblastoma: Pre-ganglionic

Why will HA drop testing be non-localizing if the Horner syndrome is secondary to a history of neck trauma from forceps delivery?

What implications does this hold for managing Horner syndrome in children?
It implies one cannot rely on HA testing to differentiate between pre- and post-ganglionic Horner’s in children. Because of this, drop testing cannot be relied upon to rule out neuroblastoma.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic

Why will HA drop testing be non-localizing if the Horner syndrome is secondary to a history of neck trauma from forceps delivery?

What implications does this hold for managing Horner syndrome in children?
It implies one cannot rely on HA testing to differentiate between pre- and post-ganglionic Horner’s in children. Because of this, drop testing cannot be relied upon to rule out neuroblastoma.

Which is more likely to be associated with neuroblastoma: A congenital Horner’s, or one acquired in infancy or early childhood?
Wallenberg syndrome: Central
Neck trauma: Pre- or post-ganglionic
Neuroblastoma: Pre-ganglionic

Why will HA drop testing be non-localizing if the Horner syndrome is secondary to a history of neck trauma from forceps delivery?

What implications does this hold for managing Horner syndrome in children?
It implies one cannot rely on HA testing to differentiate between pre- and post-ganglionic Horner’s in children. Because of this, drop testing cannot be relied upon to rule out neuroblastoma.

Which is more likely to be associated with neuroblastoma: A congenital Horner’s, or one acquired in infancy or early childhood?
Acquired Horner’s
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic

Why will HA drop testing be non-localizing if the Horner syndrome is secondary to a history of neck trauma from forceps delivery?

What implications does this hold for managing Horner syndrome in children? It implies one cannot rely on HA testing to differentiate between pre- and post-ganglionic Horner’s in children. Because of this, drop testing cannot be relied upon to rule out neuroblastoma.

Which is more likely to be associated with neuroblastoma: A congenital Horner’s, or one acquired in infancy or early childhood?
Acquired Horner’s

Absent a clear trauma history, how should one work up a Horner’s acquired in infancy/early childhood?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic

Why will HA drop testing be non-localizing if the Horner syndrome is secondary to a history of neck trauma from forceps delivery?

What implications does this hold for managing Horner syndrome in children?
It implies one cannot rely on HA testing to differentiate between pre- and post-ganglionic Horner’s in children. Because of this, drop testing cannot be relied upon to rule out neuroblastoma.

Which is more likely to be associated with neuroblastoma: A congenital Horner’s, or one acquired in infancy or early childhood?
Acquired Horner’s

Absent a clear trauma history, how should one work up a Horner’s acquired in infancy/early childhood?
In addition to a thorough H&P by a pediatrician, urine catecholamine (VMA, etc) testing should be undertaken. Careful consideration should be given to imaging the entire sympathetic chain as well.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic

Why will HA drop testing be non-localizing if the Horner syndrome is secondary to a history of neck trauma from forceps delivery?

What implications does this hold for managing Horner syndrome in children?
It implies one cannot rely on HA testing to differentiate between pre- and post-ganglionic Horner’s in children. Because of this, drop testing cannot be relied upon to rule out neuroblastoma.

Which is more likely to be associated with neuroblastoma: A congenital Horner’s, or one acquired in infancy or early childhood?
Acquired Horner’s

Absent a clear trauma history, how should one work up a Horner’s acquired in infancy/early childhood?
In addition to a thorough H&P by a pediatrician, urine catecholamine (VMA, etc) testing should be undertaken. Careful consideration should be given to imaging the entire sympathetic chain as well.

What about a congenital Horner’s--how should that be worked up?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic

Why will HA drop testing be non-localizing if the Horner syndrome is secondary to a history of neck trauma from forceps delivery?

What implications does this hold for managing Horner syndrome in children?
It implies one cannot rely on HA testing to differentiate between pre- and post-ganglionic Horner’s in children. Because of this, drop testing cannot be relied upon to rule out neuroblastoma.

Which is more likely to be associated with neuroblastoma: A congenital Horner’s, or one acquired in infancy or early childhood?
Acquired Horner’s

Absent a clear trauma history, how should one work up a Horner’s acquired in infancy/early childhood?
In addition to a thorough H&P by a pediatrician, urine catecholamine (VMA, etc) testing should be undertaken. Careful consideration should be given to imaging the entire sympathetic chain as well.

What about a congenital Horner’s--how should that be worked up?
There is less consensus on this score. If other stigmata of birth trauma are present (eg, brachial plexus injury), a workup is unnecessary. Absent such a history, relatively low-cost and low-risk maneuvers such as a thorough H&P and urine catecholamine testing are reasonable to undertake. It is less certain that imaging of the entire sympathetic chain is warranted.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

In actuality, cocaine and HA drop testing are rarely performed—why?

How does one ‘prove’ a patient has a Horners?

Cocaine drop testing. Cocaine will essentially eliminate anisocoria if and only if the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horners?

Hydroxyamphetamine (HA) drop testing. HA drops will eliminate anisocoria if the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horners.
In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

How does one ‘prove’ a patient has a Horner's?

**Cocaine drop testing.** Cocaine will essentially eliminate anisocoria *if and only if* the sympathetic chain is intact.

*How does one differentiate between a pre- and post-ganglionic Horner’s?*

**Hydroxyamphetamine (HA) drop testing.** HA drops will eliminate anisocoria *if* the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horner’s.
In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

*What drop test can be performed in their stead?*

How does one ‘prove’ a patient has a Horner’s?

**Cocaine drop testing.** Cocaine will essentially eliminate anisocoria *if and only if* the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horner’s?

**Hydroxyamphetamine (HA) drop testing.** HA drops will eliminate anisocoria *if* the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horner’s.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain

What drop test can be performed in their stead? Apraclonidine (Iopidine) testing

How does one ‘prove’ a patient has a Horners? Cocaine drop testing. Cocaine will essentially eliminate anisocoria if and only if the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horners? Hydroxyamphetamine (HA) drop testing. HA drops will eliminate anisocoria if the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horners.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead? Apraclonidine (lopidine) testing.

What is apraclonidine commonly used for?

Apraclonidine is commonly used for:
- Ocular hypotensive
- To blunt perioperative pressure spikes

What is its mechanism of action? It is a nonselective alpha-adrenergic agonist.

Which alpha receptors are involved in pupil dilation?

- Alpha_2

How does one ‘prove’ a patient has a Horner’s?

**Cocaine drop testing.** Cocaine will essentially eliminate anisocoria if and only if the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horner’s?

**Hydroxyamphetamine (HA) drop testing.** HA drops will eliminate anisocoria if the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horner’s.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

In actuality, cocaine and HA drop testing are rarely performed—why?
These drugs are highly controlled substances—difficult to acquire and maintain

What drop test can be performed in their stead?
Apraclonidine (Iopidine) testing

What is apraclonidine commonly used for?
An ocular hypotensive, it is used to blunt perioperative pressure spikes

How does one ‘prove’ a patient has a Horner’s?
**Cocaine drop testing.** Cocaine will essentially eliminate anisocoria *if and only if* the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horner’s?
**Hydroxyamphetamine (HA) drop testing.** HA drops will eliminate anisocoria *if* the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horner’s.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead? Apraclonidine (Iopidine) testing.

What is apraclonidine commonly used for? An ocular hypotensive, it is used to blunt perioperative pressure spikes.

What is its mechanism of action?

How does one ‘prove’ a patient has a Horner’s?

**Cocaine drop testing.** Cocaine will essentially eliminate anisocoria if and only if the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horner’s?

**Hydroxyamphetamine (HA) drop testing.** HA drops will eliminate anisocoria if the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horner’s.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain

What drop test can be performed in their stead? Apraclonidine (Iopidine) testing

What is apraclonidine commonly used for? An ocular hypotensive, it is used to blunt perioperative pressure spikes

What is its mechanism of action? It is a selective alpha-adrenergic agonist

How does one ‘prove’ a patient has a Horner’s?
Cocaine drop testing. Cocaine will essentially eliminate anisocoria if and only if the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horner’s?
Hydroxyamphetamine (HA) drop testing. HA drops will eliminate anisocoria if the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horner’s.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead? Apraclonidine (Iopidine) testing.

What is apraclonidine commonly used for? An ocular hypotensive, it is used to blunt perioperative pressure spikes.

What is its mechanism of action? It is a selective alpha-adrenergic agonist.

Which alpha receptors are involved in pupil dilation?

How does one ‘prove’ a patient has a Horner’s? 
**Cocaine drop testing.** Cocaine will essentially eliminate anisocoria *if and only if* the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horner’s? **Hydroxyamphetamine (HA) drop testing.** HA drops will eliminate anisocoria *if* the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horner’s.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead? Apraclonidine (Iopidine) testing.

What is apraclonidine commonly used for? An ocular hypotensive, it is used to blunt perioperative pressure spikes.

What is its mechanism of action? It is a selective alpha-adrenergic agonist.

Which alpha receptors are involved in pupil dilation? Alpha_1.

How does one ‘prove’ a patient has a Horner’s?
**Cocaine drop testing.** Cocaine will essentially eliminate anisocoria if and only if the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horner’s?
**Hydroxyamphetamine (HA) drop testing.** HA drops will eliminate anisocoria if the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horner’s.
In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead? **Apraclonidine (lopidine) testing**

What is apraclonidine commonly used for? An ocular hypotensive, it is used to blunt perioperative pressure spikes.

What is its mechanism of action? It is a nonselective alpha-2 adrenergic agonist.

Which alpha receptors are involved in pupil dilation? \( \alpha_1 \)

How is apraclonidine used in diagnosing Horner syndrome? It is instilled in both eyes. If the anisocoria reverses, the Horner's is confirmed.

How is apraclonidine used to differentiate between a pre- and post-ganglionic Horner's? It can't be used to differentiate.

How does one ‘prove’ a patient has a Horner's? **Cocaine drop testing.** Cocaine will essentially eliminate anisocoria *if and only if* the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horner's? **Hydroxyamphetamine (HA) drop testing.** HA drops will eliminate anisocoria *if* the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horner's.

For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

Wallenberg syndrome: Central
Neck trauma: Pre-or post-ganglionic
Neuroblastoma: Pre-ganglionic
Internal carotid dissection: Post-ganglionic
Pancoast tumor: Pre-ganglionic
Cluster HA: Post-ganglionic
Forceps delivery: Pre- or post-ganglionic

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead?
**Apraclonidine (lopidine) testing**

What is apraclonidine commonly used for?
An ocular hypotensive, it is used to blunt perioperative pressure spikes.

How is apraclonidine used in diagnosing Horner syndrome?
It is instilled in both eyes. If the anisocoria reverses, the Horner's is confirmed.

Which alpha receptors are involved in pupil dilation?
Alpha_1_

How does one ‘prove’ a patient has a Horner’s?
**Cocaine drop testing.** Cocaine will essentially eliminate anisocoria *if and only if* the sympathetic chain is intact.

How does one differentiate between a pre- and post-ganglionic Horner’s?
**Hydroxyamphetamine (HA) drop testing.** HA drops will eliminate anisocoria *if* the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horner’s.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead?
**Apraclonidine (Iopidine) testing**

What is apraclonidine commonly used for?
An ocular hypotensive, it is used to blunt perioperative pressure spikes.

How is apraclonidine used in diagnosing Horner syndrome?
It is instilled in both eyes. **If the anisocoria reverses, the Horner's is confirmed.**

What is the physiological basis of anisocoria reversal in response to apraclonidine in Horner syndrome?

- **Denervation supersensitivity.** Horner syndrome results in upregulation of alpha\(_1\) receptors on the pupillary dilator muscle of the affected eye; therefore, this eye will exhibit a stronger response to apraclonidine instillation, and will thus dilate to a degree greater than the normal fellow eye.

In addition to anisocoria reversal, what other response to apraclonidine is suggestive of Horner syndrome?
**Resolution of ptosis**

What is the pathophysiology of ptosis in Horner syndrome?
The absence of sympathetic stimulation to Müller's muscle of the lid produces a mild ptosis.

In actuality, cocaine and HA drop testing are rarely performed—why?
These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead?
**Apraclonidine (Iopidine) testing**

What is apraclonidine commonly used for?
An ocular hypotensive, it is used to blunt perioperative pressure spikes.

How is apraclonidine used in diagnosing Horner syndrome?
It is instilled in both eyes. **If the anisocoria reverses, the Horner's is confirmed.**

Which alpha receptors are involved in pupil dilation?
**Alpha\(_1\)**

What is apraclonidine used to differentiate between a pre- and post-ganglionic Horner's?
It can't.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

Wallenberg syndrome: Central
Neck trauma: Pre or post-ganglionic
Neuroblastoma: Pre-ganglionic
Internal carotid dissection: Post-ganglionic
Pancoast tumor: Pre-ganglionic
Cluster HA: Post-ganglionic
Forceps delivery: Pre- or post-ganglionic

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead? **Apraclonidine (Iopidine) testing**

What is apraclonidine commonly used for? An ocular hypotensive, it is used to blunt perioperative pressure spikes.

How is apraclonidine used in diagnosing Horner syndrome? It is instilled in both eyes. **If the anisocoria reverses, the Horners is confirmed.**

Which alpha receptors are involved in pupil dilation? Alpha₁

What is the physiological basis of anisocoria reversal in response to apraclonidine in Horner syndrome? **Denervation supersensitivity.** Horner syndrome results in upregulation of alpha₁ receptors on the pupillary dilator muscle of the affected eye; therefore, this eye will exhibit a stronger response to apraclonidine instillation, and will thus dilate to a degree greater than the normal fellow eye.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead? **Apraclonidine (Iopidine) testing**

What is apraclonidine commonly used for? An ocular hypotensive, it is used to blunt perioperative pressure spikes.

How is apraclonidine used in diagnosing Horner syndrome? It is instilled in both eyes. If the anisocoria reverses, the Horner's is confirmed.

Which alpha receptors are involved in pupil dilation? Alpha_1.

What is the physiological basis of anisocoria reversal in response to apraclonidine in Horner syndrome? Denervation supersensitivity. Horner syndrome results in upregulation of alpha_1 receptors on the pupillary dilator muscle of the affected eye; therefore, this eye will exhibit a stronger response to apraclonidine instillation compared with the dilator muscle in the normal fellow eye.

How long after the Horner-inciting injury to the sympathetic pathway does it take for denervation supersensitivity to develop?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead?

**Apraclonidine (Iopidine) testing**

What is apraclonidine commonly used for?

How is apraclonidine used in diagnosing Horner syndrome?

It is instilled in both eyes. **If the anisocoria reverses, the Horner's is confirmed.**

Which alpha receptors are involved in pupil dilation?

Alpha₁

What is the physiological basis of anisocoria reversal in response to apraclonidine in Horner syndrome?

**Denervation supersensitivity**. Horner syndrome results in upregulation of alpha₁ receptors on the pupillary dilator muscle of the affected eye; therefore, this eye will exhibit a stronger response to apraclonidine instillation compared with the healthy eye, leading to anisocoria reversal.

How long after the Horner-inciting injury to the sympathetic pathway does it take for denervation supersensitivity to develop?

In general, a few days (case reports exist of it occurring in as little as a few hours).
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated:

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead?
**Apraclonidine (Iopidine) testing**

What is apraclonidine commonly used for?
An ocular hypotensive, it is used to blunt perioperative pressure spikes.

How is apraclonidine used in diagnosing Horner syndrome?
It is instilled in both eyes. If the anisocoria reverses, the Horner's is confirmed.

Which alpha receptors are involved in pupil dilation?
**Alpha**

What is the physiological basis of anisocoria reversal in response to apraclonidine in Horner syndrome?
**Denervation supersensitivity.** Horner syndrome results in upregulation of alpha₁ receptors on the pupillary dilator muscle of the affected eye; therefore, this eye will exhibit a stronger response to apraclonidine instillation, and will thus dilate to a degree greater than the normal fellow eye.

In addition to anisocoria reversal, what other response to apraclonidine is suggestive of Horner syndrome?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead?
**Apraclonidine (Iopidine) testing**

What is apraclonidine commonly used for?

How is apraclonidine used in diagnosing Horner syndrome? It is instilled in both eyes. If the anisocoria reverses, the Horner's is confirmed.

Which alpha receptors are involved in pupil dilation?
Alpha₁

What is the physiological basis of anisocoria reversal in response to apraclonidine in Horner syndrome? **Denervation supersensitivity**. Horner syndrome results in upregulation of alpha₁ receptors on the pupillary dilator muscle of the affected eye; therefore, this eye will exhibit a stronger response to apraclonidine instillation, and will thus dilate to a degree greater than the normal fellow eye.

In addition to anisocoria reversal, what other response to apraclonidine is suggestive of Horner syndrome? Resolution of ptosis.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- **Wallenberg syndrome**: Central
- **Neck trauma**: Pre- or post-ganglionic
- **Neuroblastoma**: Pre-ganglionic
- **Internal carotid dissection**: Post-ganglionic
- **Pancoast tumor**: Pre-ganglionic
- **Cluster HA**: Post-ganglionic
- **Forceps delivery**: Pre- or post-ganglionic

**Q**

*In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.*

**What drop test can be performed in their stead?**

**Apraclonidine (Iopidine) testing**

**How is apraclonidine used in diagnosing Horner syndrome?**

It is instilled in both eyes. If the anisocoria reverses, the Horner's is confirmed.

**What is apraclonidine commonly used for?**

An ocular hypotensive, it is used to blunt perioperative pressure spikes

**What is its mechanism of action?**

It is a nonselective alpha-agonist

**Which alpha receptors are involved in pupil dilation?**

Alpha₁

**What is the physiological basis of anisocoria reversal in response to apraclonidine in Horner syndrome?**

*Denervation supersensitivity*. Horner syndrome results in upregulation of alpha₁ receptors on the pupillary dilator muscle of the affected eye; therefore, this eye will exhibit a stronger response to apraclonidine instillation, and will thus dilate to a degree greater than the normal fellow eye.

**In addition to anisocoria reversal, what other response to apraclonidine is suggestive of Horner syndrome?**

Resolution of ptosis

**What is the pathophysiology of ptosis in Horner syndrome?**
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead? **Apraclonidine (Iopidine) testing**

What is apraclonidine commonly used for? An ocular hypotensive, it is used to blunt perioperative pressure spikes.

How is apraclonidine used in diagnosing Horner syndrome? It is instilled in both eyes. If the anisocoria reverses, the Horner's is confirmed.

Which alpha receptors are involved in pupil dilation? Alpha_1

What is the physiological basis of anisocoria reversal in response to apraclonidine in Horner syndrome? **Denervation supersensitivity**. Horner syndrome results in upregulation of alpha_1 receptors on the pupillary dilator muscle of the affected eye; therefore, this eye will exhibit a stronger response to apraclonidine instillation, and will thus dilate to a degree greater than the normal fellow eye.

In addition to anisocoria reversal, what other response to apraclonidine is suggestive of Horner syndrome? Resolution of ptosis

What is the pathophysiology of ptosis in Horner syndrome? The absence of sympathetic stimulation to Müller’s muscle of the lid produces a mild ptosis.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

1. Wallenberg syndrome: Central
2. Neck trauma: Pre- or post-ganglionic
3. Neuroblastoma: Pre-ganglionic
4. Internal carotid dissection: Post-ganglionic
5. Pancoast tumor: Pre-ganglionic
6. Cluster HA: Post-ganglionic
7. Forceps delivery: Pre- or post-ganglionic

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead?

**Apraclonidine (Iopidine) testing**

What is apraclonidine commonly used for?

It is a nonselective alpha-adrenergic agonist.

Which alpha receptors are involved in pupil dilation?

**Alpha₁**

How is apraclonidine used in diagnosing Horner syndrome?

It is instilled in both eyes. If the anisocoria reverses, the Horner’s is confirmed.

How is apraclonidine used to differentiate between a pre- and post-ganglionic Horner’s?

It can't
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead? **Apraclonidine (Iopidine) testing**

What is apraclonidine commonly used for? An ocular hypotensive, it is used to blunt perioperative pressure spikes.

What is its mechanism of action? It is a nonselective alpha-2 adrenergic agonist.

Which alpha receptors are involved in pupil dilatation? Alpha_1_

How is apraclonidine used in diagnosing Horner syndrome? It is instilled in both eyes. If the anisocoria reverses, the Horner's is confirmed.

How is apraclonidine used to differentiate between a pre- and post-ganglionic Horner's? It can't.

Apraclonidine (Iopidine) testing
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead?
**Apraclonidine (Iopidine) testing**

I’m out of apraclonidine. Can I use brimonidine instead?

Apraclonidine is a non-selective alpha receptor agonist, while brimonidine is a highly selective alpha2 agonist. Therefore, brimonidine will not induce pupil dilation.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead?

**Apraclonidine (Iopidine) testing**

I’m out of apraclonidine. Can I use brimonidine instead?

I’m afraid not.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead? 
**Apraclonidine (Iopidine) testing**

I'm out of apraclonidine. Can I use brimonidine instead? I'm afraid not.

Why not? Aren't they very similar meds?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

In actuality, cocaine and HA drop testing are rarely performed—why? These drugs are highly controlled substances—difficult to acquire and maintain.

What drop test can be performed in their stead?
**Apraclonidine (Iopidine) testing**

I’m out of apraclonidine. Can I use brimonidine instead?
I’m afraid not.

Why not? Aren’t they very similar meds?
For purposes of Horner drop-testing, not similar enough. While apraclonidine preferentially stimulates the \( \alpha_2 \) receptor, it still provides some stimulation of the \( \alpha_1 \) receptors of the dilator muscles. In contrast, bromonidine is a **highly**-selective \( \alpha_2 \) agonist, and as such provides little to no \( \alpha_1 \) stimulation, and therefore will **not** induce pupil dilation.
Which drop test differentiates between a pre-ganglionic and central Horner's syndrome?

None. A central Horner's is usually apparent by the company it keeps, or by history.

For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated:

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

Which drop test differentiates between a pre-ganglionic and central Horner's syndrome?
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: **Central**
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: **Pre-ganglionic**
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

Which drop test differentiates between a pre-ganglionic and central Horner's? **None.** A central Horner's is usually apparent by the company it keeps, or by history.
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated.

- Wallenberg syndrome: **Central**
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: **Pre-ganglionic**
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

Which drop test differentiates between a pre-ganglionic and central Horner's? **None.** A central Horner's is usually apparent by **the company it keeps**, or by history.

What sorts of findings would be associated with a central Horner's?

Significant neurological impairment including difficulties with speaking, swallowing and/or balance, as well as disordered movements (i.e., a Wallenberg-type scenario).
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: **Central**
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: **Pre-ganglionic**
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

Which drop test differentiates between a pre-ganglionic and central Horner's? **None.** A central Horner is usually apparent by the company it keeps, or by history.

What sorts of findings would be associated with a central Horner's? Significant neurological impairment including difficulties with speaking, swallowing and/or balance, as well as disordered movements (ie, a Wallenberg-type scenario)
Which drop test differentiates between a pre-ganglionic and central Horner’s?
None. A central Horner’s is usually apparent by the company it keeps, or by history.

What history would be associated with a central Horner’s?
Associated history could include significant intracranial events (CVA, tumor, meningitis, a bleed) or a history of significant high C-spine trauma (fracture, dislocation).

For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated:

- Wallenberg syndrome: **Central**
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: **Pre-ganglionic**
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic
Which drop test differentiates between a pre-ganglionic and central Horner's?

None. A central Horner's is usually apparent by the company it keeps, or by history.

What history would be associated with a central Horner's?
Associated history could include significant intracranial events (CVA, tumor, meningitis, a bleed) or a history of significant high C-spine trauma (fracture, dislocation).

For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated:

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic
Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:

- Head
- Neck
- Upper chest
- Skull base
- Internal carotid artery (esp. at the skull base)
- Paraspinal area
- Mediastinum
Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:

- Head

- Neck

- Upper chest

- Skull base

- Internal carotid artery (esp. at the skull base)

- Paraspinal area

- Mediastinum
Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:

- Head

...with attention to the:

- specific aspect of head
Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:

- Head

...with attention to the:

- Skull base
Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:

- Head
- Neck
- Upper chest
- Skull base
- Internal carotid artery (esp. at the skull base)
- Paraspinal area
- Mediastinum

...with attention to the:

- Skull base
Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:

- Head
- Neck

...with attention to the:

- Skull base
Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:

- Head
- Neck

...with attention to the:

- Skull base
- specific structure in neck
Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:

- **Head**
- **Neck**

...with attention to the:

- **Skull base**
- **Internal carotid artery**
Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:

- Head
- Neck
- General body area 3

...with attention to the:

- Skull base
- Internal carotid artery
Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:

- Head
- Neck
- Upper chest

…with attention to the:

- Skull base
- Internal carotid artery
Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:

- Head
- Neck
- Upper chest

...with attention to the:

- Skull base
- Internal carotid artery
- specific aspect of chest 1
- specific aspect of chest 2
Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:

- Head
- Neck
- Upper chest

…with attention to the:

- Skull base
- Internal carotid artery
- Paraspinal area
- Mediastinum