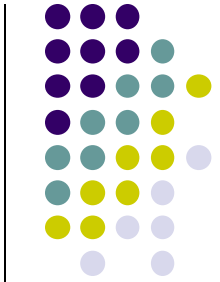
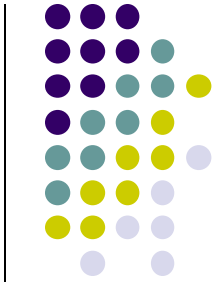


Before you begin: This is a big topic, and big topics beget big slide-sets. There are natural breaks around slides 90 and 254; I placed a *break time!* slide at those points to mark them.

Horner Syndrome

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

Horner Syndrome



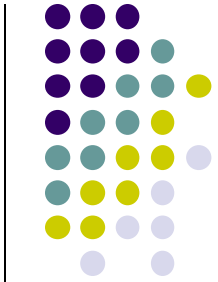
- Cause: *Sympathetic dysfunction*
- Triad:
  - Ptosis
  - Miosis
  - Anhidrosis

Horner Syndrome

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

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

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

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**

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 2ndry to Horners?
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 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 2ndry to Horners?
The upper lid is too…low
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 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 2ndry to Horners?
The upper lid is too…low
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 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 2ndry to Horners?
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 2ndry to Horners?
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 muscle is most influential in terms of positioning the upper lid?

erpalpebral fissure

e upper lid, the

ry to Horners?

The upper lid is too…low

The lower lid is too…high

Horner Syndrome

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

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

erpalpebral fissure

e upper lid, the

ry to Horners?

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

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?

erpalpebral fissure

e upper lid, the

ry to Horners?

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

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

erpalpebral fissure

e upper lid, the

ry to Horners?

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

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 Horners?

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

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 Horners?
No

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

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
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 Horners?*

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
No

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

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

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
No

The upper lid is too…low

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

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

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
No

The upper lid is too…low

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

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

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
No

The upper lid is too…low

If not the levator, what named muscle **is** *implicated in the ptosis associated with Horners?*
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?

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
No

The upper lid is too…low

If not the levator, what named muscle **is** *implicated in the ptosis associated with Horners?*
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 [redacted] branch of the ANS)

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
No

The upper lid is too…low

If not the levator, what named muscle **is** *implicated in the ptosis associated with Horners?*
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 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
No

The upper lid is too…low

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

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

Where is Müller's muscle located?

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
No

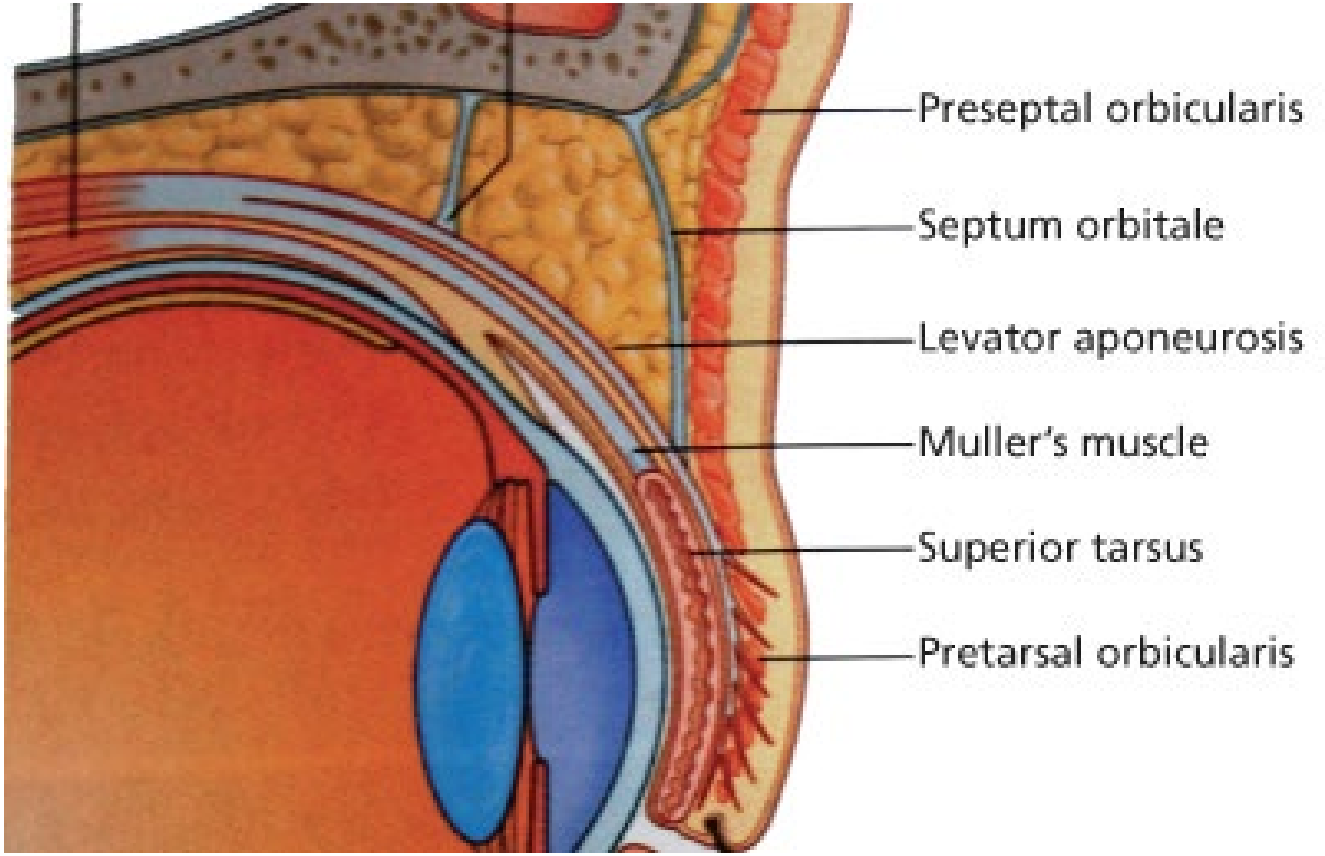
The upper lid is too…low

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

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

Where is Müller's muscle located?
Deep to the distal tendon of the levator; it attaches to the superior border of the tarsal plate of the upper lid

Horner Syndrome



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**

If innervation to the levator is lost, how much ptosis results?

No

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

ned muscle **is** *implicated in Horners?*
Müller's muscle

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

Where is Müller's muscle located?
Deep to the distal tendon of the levator; it attaches to the superior border of the tarsal plate of the upper lid

e upper lid, the

Horner Syndrome

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

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

If innervation to the levator is lost, how much ptosis results?
Total/complete—the lid is closed

No

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

ned muscle **is** *implicated in Horners?*
Müller's muscle

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

Where is Müller's muscle located?
Deep to the distal tendon of the levator; it attaches to the superior border of the tarsal plate of the upper lid

e upper lid, the

erpalpebral fissure

Horner Syndrome

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

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

If innervation to the levator is lost, how much ptosis results?
Total/complete—the lid is closed

If innervation to Müller's muscle is lost, how much ptosis results?

No

Müller's muscle

The upper lid is too…low

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

Where is Müller's muscle located?
Deep to the distal tendon of the levator; it attaches to the superior border of 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**

If innervation to the levator is lost, how much ptosis results?
Total/complete—the lid is closed

If innervation to Müller's muscle is lost, how much ptosis results?
Not nearly so much—about # mm or so

No

Müller's muscle

The upper lid is too…low

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

Where is Müller's muscle located?
Deep to the distal tendon of the levator; it attaches to the superior border of 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**

If innervation to the levator is lost, how much ptosis results?
Total/complete—the lid is closed

If innervation to Müller's muscle is lost, how much ptosis results?
Not nearly so much—about 2 mm or so

No

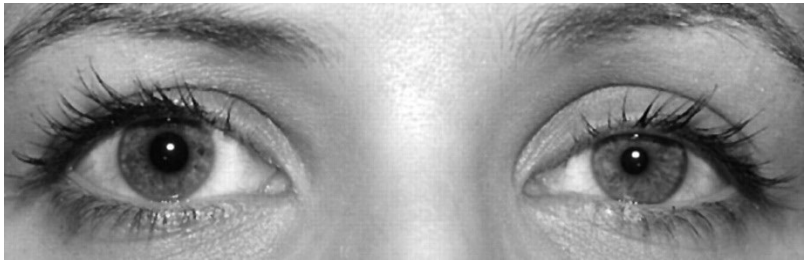
Müller's muscle

The upper lid is too…low

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

Where is Müller's muscle located?
Deep to the distal tendon of the levator; it attaches to the superior border of the tarsal plate of the upper lid

Horner Syndrome



Horner’s ptosis in adult

Horner’s ptosis in infant

Horner syndrome: Ptosis

Horner Syndrome

Horner's ptosis in adult

Not Horner's ptosis in child (ptoo ptotic)

Horner's ptosis in infant

Not Horner's ptosis in adult (ptoo ptotic)

Horner syndrome: Ptosis

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
No

If not the levator, what named muscle **is** *implicated in*

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

Deep to the distal tendon of the levator; it attaches to the superior border of the tarsal plate of **the upper lid**

The lower lid is too…high

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
No

If not the levator, what named muscle **is** *implicated in*

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.)

The lower lid is too…high

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
No

If not the levator, what named muscle **is** *implicated in*

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

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

The lower lid is too…high

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
No

If not the levator, what named muscle **is** *implicated in*

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

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)

The lower lid is too…high

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
No

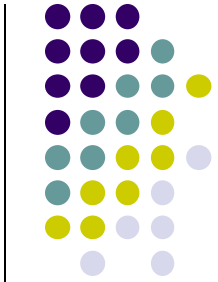
If not the levator, what named muscle **is** *implicated in*

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 weake

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)

The lower lid is too…high

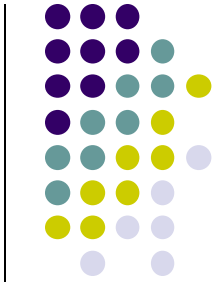
Horner Syndrome



- 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.

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-dilation) innervation is reduced in one eye, its relatively unopposed parasympathetic (=pro-miosis) inputs will have an outsized effect, and the pupil will be relatively miosed in comparison to that of the fellow eye.

Horner Syndrome

Horner's miosis in adult

Horner's miosis in infant

Horner syndrome: Miosis

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?

relatively miotic

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-dilation) innervation is reduced in one eye, its relatively unopposed parasympathetic (=pro-miosis) inputs will have an outsized effect, and the 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-dilation) innervation is reduced in one eye, its relatively unopposed parasympathetic (=pro-miosis) inputs will have an outsized effect, and the 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?

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?

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?

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 suggests 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**

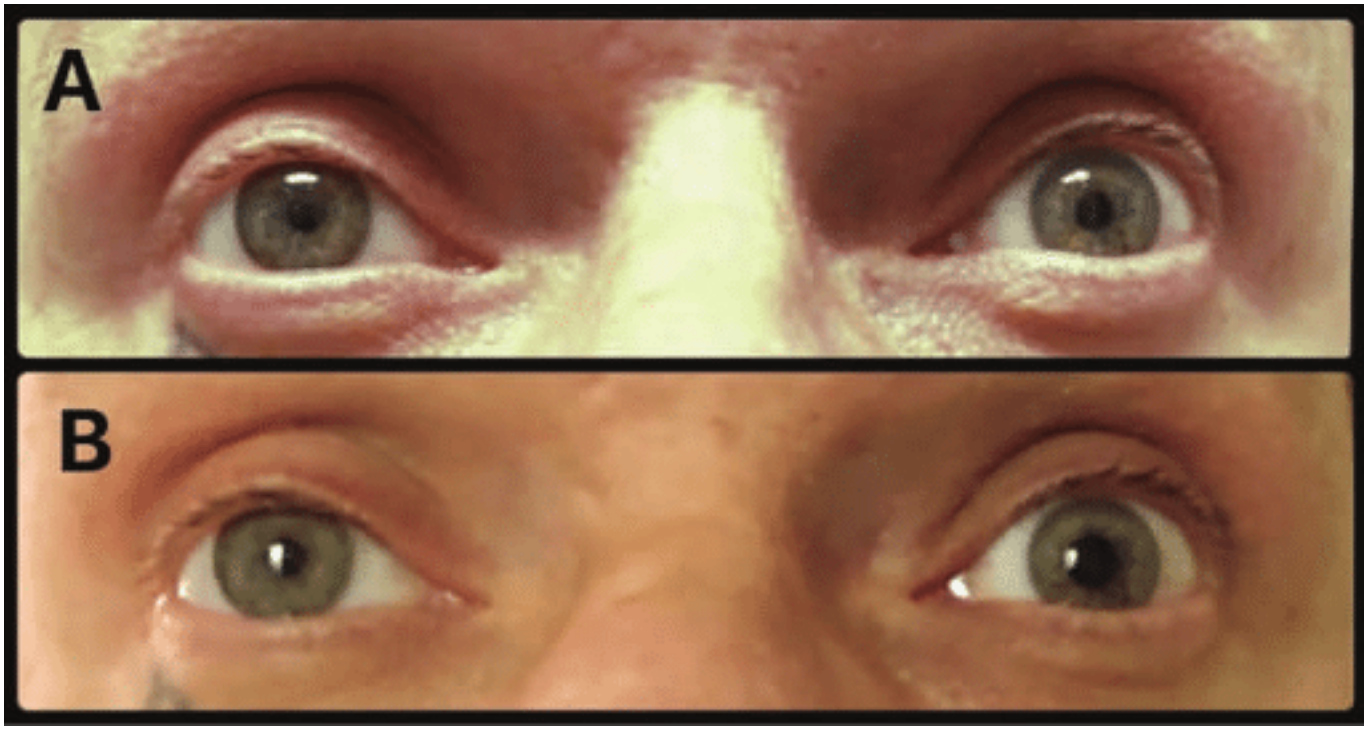
'Relatively miotic' implies the pupils are not the same size. What term describes a state of unequal pupil sizes?

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 suggests 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



Horner syndrome: Anisocoria greater in dim light

Horner Syndrome

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

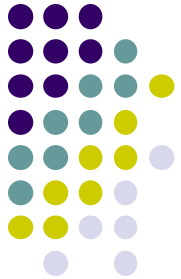
'Relatively miotic' implies the pupils are not the same size. What term describes a state of unequal pupil sizes?

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 suggests 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 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 suggests 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?

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

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 suggests 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?

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

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 suggests 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:

Hold the phone: The word 'suggests' here seems to indicate it's possible that anisocoria-greater-in-dim-light isn't necessarily diagnostic of a sympathetic lesion. Is this the case?

anisocoria is more pronounced in **dim** light, this ***suggests*** the smaller pupil isn't dilating properly,

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:

Hold the phone: The word 'suggests' here seems to indicate it's possible that anisocoria-greater-in-dim-light isn't necessarily diagnostic of a sympathetic lesion. Is this the case?
It is, unfortunately—physiologic anisocoria sometimes displays the same pattern, ie, it is worse in dim light.

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 ***suggests*** 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:

Hold the phone: The word 'suggests' here seems to indicate it's possible that anisocoria-greater-in-dim-light isn't necessarily diagnostic of a sympathetic lesion. Is this the case?
It is, unfortunately—physiologic anisocoria sometimes displays the same pattern, ie, it is worse in dim light. This can make differentiating Horners anisocoria from physiologic anisocoria especially challenging.

How can you tell which pupil is the culprit?

anisocoria is more pronounced in **dim** light, this ***suggests*** the smaller pupil isn't dilating properly,

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:

Hold the phone: The word 'suggests' here seems to indicate it's possible that anisocoria-greater-in-dim-light isn't necessarily diagnostic of a sympathetic lesion. Is this the case?
It is, unfortunately—physiologic anisocoria sometimes displays the same pattern, ie, it is worse in dim light. This can make differentiating Horners anisocoria from physiologic anisocoria especially challenging.

Is there anything about pupil function that distinguishes a Horners pupil from a physiologically smaller one?

How can you tell which pupil is the culprit?

anisocoria is more pronounced in **dim** light, this ***suggests*** 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:

Hold the phone: The word 'suggests' here seems to indicate it's possible that anisocoria-greater-in-dim-light isn't necessarily diagnostic of a sympathetic lesion. Is this the case?
It is, unfortunately—physiologic anisocoria sometimes displays the same pattern, ie, it is worse in dim light. This can make differentiating Horners anisocoria from physiologic anisocoria especially challenging.

Is there anything about pupil function that distinguishes a Horners pupil from a physiologically smaller one?
There is indeed. Whatever dilation in dim light that does occur in the miotic pupil in physiologic anisocoria proceeds at the same speed as the dilation occurring in the fellow pupil.

How can you tell which pupil is the culprit?

anisocoria is more pronounced in **dim** light, this ***suggests*** the smaller pupil isn't dilating properly,

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:

Hold the phone: The word 'suggests' here seems to indicate it's possible that anisocoria-greater-in-dim-light isn't necessarily diagnostic of a sympathetic lesion. Is this the case?
It is, unfortunately—physiologic anisocoria sometimes displays the same pattern, ie, it is worse in dim light. This can make differentiating Horners anisocoria from physiologic anisocoria especially challenging.

Is there anything about pupil function that distinguishes a Horners pupil from a physiologically smaller one?
There is indeed. Whatever dilation in dim light that does occur in the miotic pupil in physiologic anisocoria proceeds at the same speed as the dilation occurring in the fellow pupil. In contrast, in Horner syndrome the miotic eye dilates much faster vs slower than its fellow eye.

How can you tell which pupil is the culprit?

anisocoria is more pronounced in **dim** light, this ***suggests*** the smaller pupil isn't dilating properly,

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:

Hold the phone: The word 'suggests' here seems to indicate it's possible that anisocoria-greater-in-dim-light isn't necessarily diagnostic of a sympathetic lesion. Is this the case?
It is, unfortunately—physiologic anisocoria sometimes displays the same pattern, ie, it is worse in dim light. This can make differentiating Horners anisocoria from physiologic anisocoria especially challenging.

Is there anything about pupil function that distinguishes a Horners pupil from a physiologically smaller one?
There is indeed. Whatever dilation in dim light that does occur in the miotic pupil in physiologic anisocoria proceeds at the same speed as the dilation occurring in the fellow pupil. In contrast, in Horner syndrome the miotic eye dilates much slower than its fellow eye.

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 ***suggests*** 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:

Hold the phone: The word 'suggests' here seems to indicate it's possible that anisocoria-greater-in-dim-light isn't necessarily diagnostic of a sympathetic lesion. Is this the case?
It is, unfortunately—physiologic anisocoria sometimes displays the same pattern, ie, it is worse in dim light. This can make differentiating Horners anisocoria from physiologic anisocoria especially challenging.

Is there anything about pupil function that distinguishes a Horners pupil from a physiologically smaller one?
There is indeed. Whatever dilation in dim light that does occur in the miotic pupil in physiologic anisocoria proceeds at the same speed as the dilation occurring in the fellow pupil. In contrast, in Horner syndrome the miotic eye dilates much slower than its fellow eye. Thus, for the first 4-5 seconds in dim light, the anisocoria will become much more pronounced in a Horner syndrome, a phenomenon not found in physiologic anisocoria.

How can you tell which pupil is the culprit?

anisocoria is more pronounced in **dim** light, this ***suggests*** the smaller pupil isn't dilating properly,

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:

Hold the phone: The word 'suggests' here seems to indicate it's possible that anisocoria-greater-in-dim-light isn't necessarily diagnostic of a sympathetic lesion. Is this the case?
It is, unfortunately—physiologic anisocoria sometimes displays the same pattern, ie, it is worse in dim light. This can make differentiating Horners anisocoria from physiologic anisocoria especially challenging.

Is there anything about pupil function that distinguishes a Horner pupil from a physiologically smaller one?
There is indeed. Whatever dilation in dim light that does occ… proceeds at the same speed as the dilation occurring in the … the miotic eye dilates much slower than its fellow eye. Thus, for the first 4-5 seconds in dim light, the anisocoria will become much more pronounced in a Horner syndrome, a phenomenon not found in physiologic anisocoria.

By what name is this phenomenon known?

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 ***suggests*** 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:

Hold the phone: The word 'suggests' here seems to indicate it's possible that anisocoria-greater-in-dim-light isn't necessarily diagnostic of a sympathetic lesion. Is this the case?
It is, unfortunately—physiologic anisocoria sometimes displays the same pattern, ie, it is worse in dim light. This can make differentiating Horners anisocoria from physiologic anisocoria especially challenging.

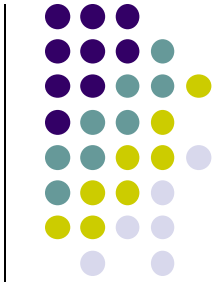
Is there anything about pupil function that distinguishes a Horners pupil from a physiologically smaller one?
There is indeed. Whatever dilation in dim light that does occ… proceeds at the same speed as the dilation occurring in the … the miotic eye dilates much slower than its fellow eye. Thus, for the first 4-5 seconds in dim light, the anisocoria will become much more pronounced in a Horner syndrome, a phenomenon not found in physiologic anisocoria.

By what name is this phenomenon known?
'Dilation lag'

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 ***suggests*** 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.

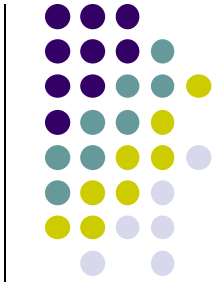
Horner Syndrome



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

What does anhidrosis *mean?*

Horner Syndrome



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

What does anhidrosis *mean?*
An inability to sweat

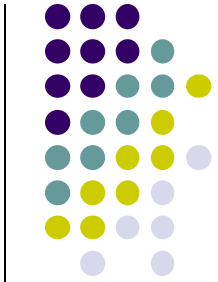
Horner Syndrome

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

What does anhidrosis *mean?*
An inability to sweat

Do Horner pts develop anhidrosis over their entire bodies?

Horner Syndrome

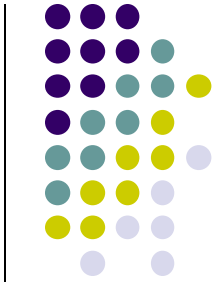


- Cause: *Sympathetic dysfunction*
- Triad:
  - Ptosis
  - Miosis
  - **Anhidrosis**

What does anhidrosis *mean?*
An inability to sweat

Do Horner pts develop anhidrosis over their entire bodies?
No, it is ipdi- vs contralateral to the lesion

Horner Syndrome



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

What does anhidrosis *mean?*
An inability to sweat

Do Horner pts develop anhidrosis over their entire bodies?
No, it is ipsilateral to the lesion

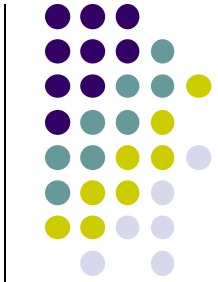
Horner Syndrome

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

What does anhidrosis *mean?*
An inability to sweat

Do Horner pts develop anhidrosis over their entire bodies?
No, it is ipsilateral to the lesion, and occurs in one of # patterns of distribution

Horner Syndrome



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

What does anhidrosis *mean?*
An inability to sweat

Do Horner pts develop anhidrosis over their entire bodies?
No, it is ipsilateral to the lesion, and occurs in one of two patterns of distribution
--***?***
--***?***

Horner Syndrome

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

What does anhidrosis *mean?*
An inability to sweat

Do Horner pts develop anhidrosis over their entire bodies?
No, it is ipsilateral to the lesion, and occurs in one of two patterns of distribution:
--The three locations
--*?*

Horner Syndrome

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

What does anhidrosis *mean?*
An inability to sweat

Do Horner pts develop anhidrosis over their entire bodies?
No, it is ipsilateral to the lesion, and occurs in one of two patterns of distribution:
--The head, face and neck
--*?*

Horner Syndrome

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

What does anhidrosis *mean?*
An inability to sweat

Do Horner pts develop anhidrosis over their entire bodies?
No, it is ipsilateral to the lesion, and occurs in one of two patterns of distribution:
--The head, face and neck
--The one location

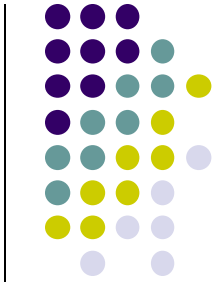
Horner Syndrome

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

What does anhidrosis *mean?*
An inability to sweat

Do Horner pts develop anhidrosis over their entire bodies?
No, it is ipsilateral to the lesion, and occurs in one of two patterns of distribution:
--The head, face and neck
--The forehead

Horner Syndrome



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

What does anhidrosis *mean?*
An inability to sweat

Do Horner pts develop anhidrosis over their entire bodies?
No, it is ipsilateral to the lesion, and occurs in one of two patterns of distribution:
--The head, face and neck
--The forehead

What determines which pattern a pt will manifest?

Horner Syndrome

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

What does anhidrosis *mean?*
An inability to sweat

Do Horner pts develop anhidrosis over their entire bodies?
No, it is ipsilateral to the lesion, and occurs in one of two patterns of distribution:
--The head, face and neck
--The forehead

What determines which pattern a pt will manifest?
The *order* of the Horners, ie, whether s/he has a first-, second-, or third-order Horner syndrome

Horner Syndrome

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

What does anhidrosis *mean?*
An inabili

Do Horne
No, it is i
patterns of distribution:
--The head, face and neck
--The forehead

What determines which pattern a pt will manifest?
The *order* of the Horners, ie, whether s/he has a **first-**, **second-**, or **third-order Horner syndrome**

What does the word order *refer to in this context?*

Horner Syndrome

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

What does anhidrosis *mean?*
An inabili

Do Horne
No, it is i
patterns of distribution:
--The head, face and neck
--The forehead

What determines which pattern a pt will manifest?
The *order* of the Horners, ie, whether s/he has a **first-**, **second-**, or **third-order Horner syndrome**

What does the word order *refer to in this context?*
It refers to which neuron in the sympathetic chain—the first, second, or third—isn't working, and is thus responsible for the Horners. (No worries if you're unsure about this 'sympathetic chain' thing—we will fully unpack this concept shortly.)

Horner Syndrome

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

What does anhidrosis *mean?*
An inabili

What does the word order *refer to in this context?*
It refers to which neuron in the sympathetic chain—the first, second, or third—

Do Horne
isn't worki
about this

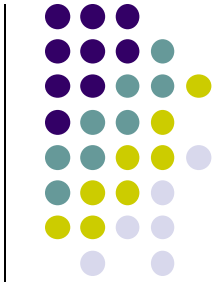
For completeness' sake: Which order of Horner syndrome produces each pattern of anhidrosis?

if you're unsure
ept shortly.)

No, it is i
patterns of distribution.
--The head, face and neck in…***?***
--The forehead in…***?***

What determines which pattern a pt will manifest?
The *order* of the Horners, ie, whether s/he has a **first-**, **second-**, or **third-order Horner syndrome**

Horner Syndrome



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

What does anhidrosis *mean?*
An inabili

Do Horne
No, it is i
patterns of distribution.

What does the word order *refer to in this context?*
It refers to which neuron in the sympathetic chain—the first, second, or third—
isn't worki
about this

For completeness' sake: Which order of Horner syndrome produces each pattern of anhidrosis?

if you're unsure
ept shortly.)

--The head, face and neck in…first- and second-order Horners
--The forehead in…third-order Horners

What determines which pattern a pt will manifest?
The *order* of the Horners, ie, whether s/he has a **first-**, **second-**, or **third-order Horner syndrome**

Horner Syndrome

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

What does anhidrosis *mean?*

In addition to anhidrosis, the appearance of the ipsilateral face may differ from the other side. In what way?

third—
're unsure
hortly.)

--The head, face and neck in…first- and second-order Horners
--The forehead in…third-order Horners

What determines which pattern a pt will manifest?
The *order* of the Horners, ie, whether s/he has a **first-**, **second-**, or **third-order Horner syndrome**

Horner Syndrome

- Cause: *Sympathetic dysfunction*
- Triad:
  - Ptosis
  - Miosis
  - **Anhidrosis** +/- *ipsilateral facial* ?

What does anhidrosis *mean?*

In addition to anhidrosis, the appearance of the ipsilateral face may differ from the other side. In what way?
It may be paler vs redder than the unaffected side

third—
're unsure
hortly.)

--The head, face and neck in…first- and second-order Horners
--The forehead in…third-order Horners

What determines which pattern a pt will manifest?
The *order* of the Horners, ie, whether s/he has a **first-**, **second-**, or **third-order Horner syndrome**

Horner Syndrome

- Cause: *Sympathetic dysfunction*
- Triad:
  - Ptosis
  - Miosis
  - **Anhidrosis** +/- *ipsilateral facial pallor*

What does anhidrosis *mean?*

In addition to anhidrosis, the appearance of the ipsilateral face may differ from the other side. In what way?
It may be paler than the unaffected side

third—
're unsure
hortly.)

--The head, face and neck in…first- and second-order Horners
--The forehead in…third-order Horners

What determines which pattern a pt will manifest?
The *order* of the Horners, ie, whether s/he has a **first-**, **second-**, or **third-order Horner syndrome**

Horner Syndrome

- Cause: *Sympathetic dysfunction*
- Triad:
  - Ptosis
  - Miosis
  - **Anhidrosis** +/- *ipsilateral facial pallor*

What does anhidrosis *mean?*

In addition to anhidrosis, the appearance of the ipsilateral face may differ from the other side. In what way?
It may be paler than the unaffected side

By what name is this phenomenon known?

third—
're unsure
hortly.)

--The head, face and neck in…first- and second-order Horners
--The forehead in…third-order Horners

What determines which pattern a pt will manifest?
The *order* of the Horners, ie, whether s/he has a **first-**, **second-**, or **third-order Horner syndrome**

Horner Syndrome

- Cause: *Sympathetic dysfunction*
- Triad:
  - Ptosis
  - Miosis
  - **Anhidrosis** +/- *ipsilateral facial pallor*

What does anhidrosis *mean?*

In addition to anhidrosis, the appearance of the ipsilateral face may differ from the other side. In what way?
It may be paler than the unaffected side

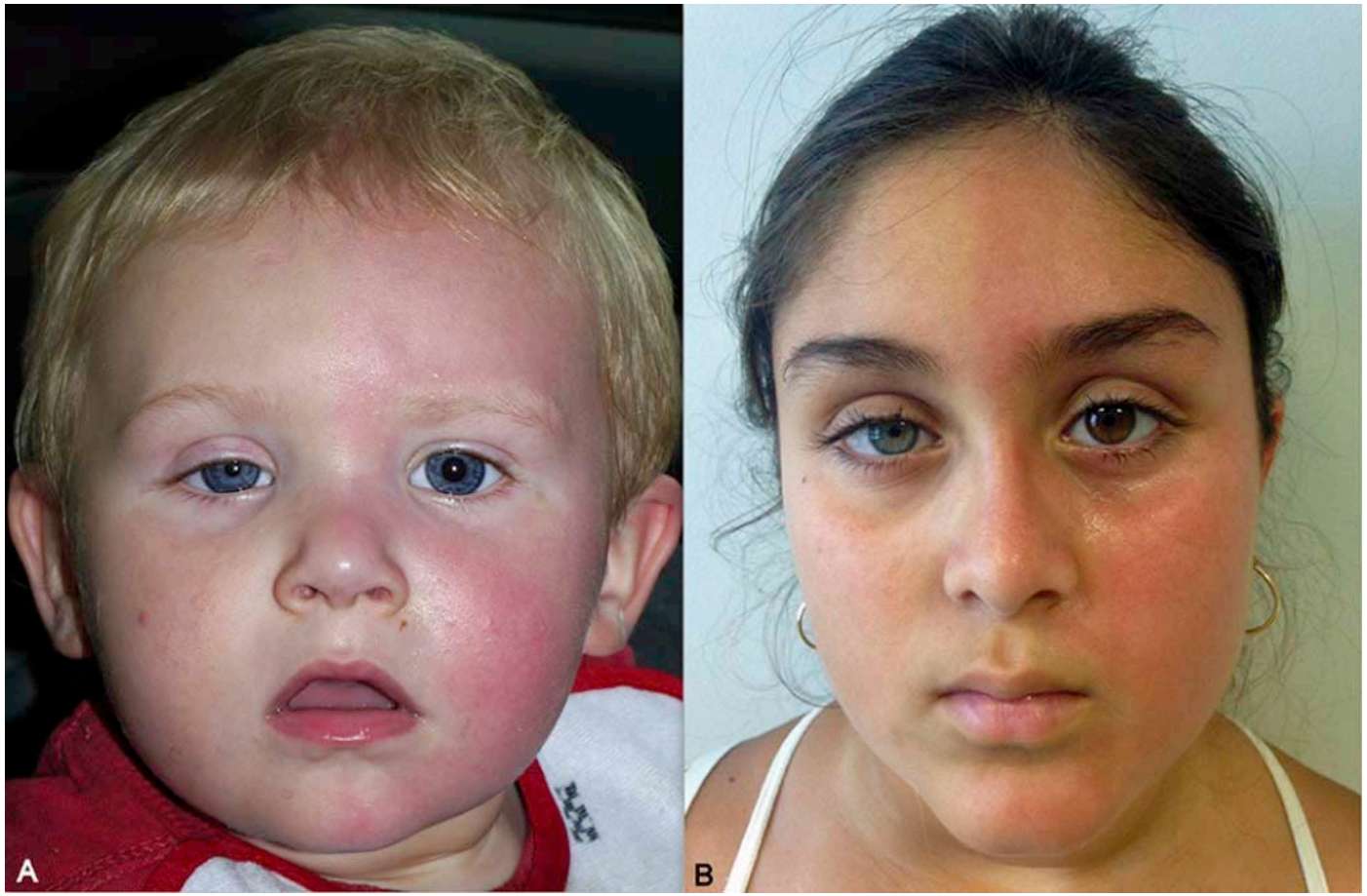
By what name is this phenomenon known?
Harlequin syndrome

--The head, face and neck in…first- and second-order Horners
--The forehead in…third-order Horners

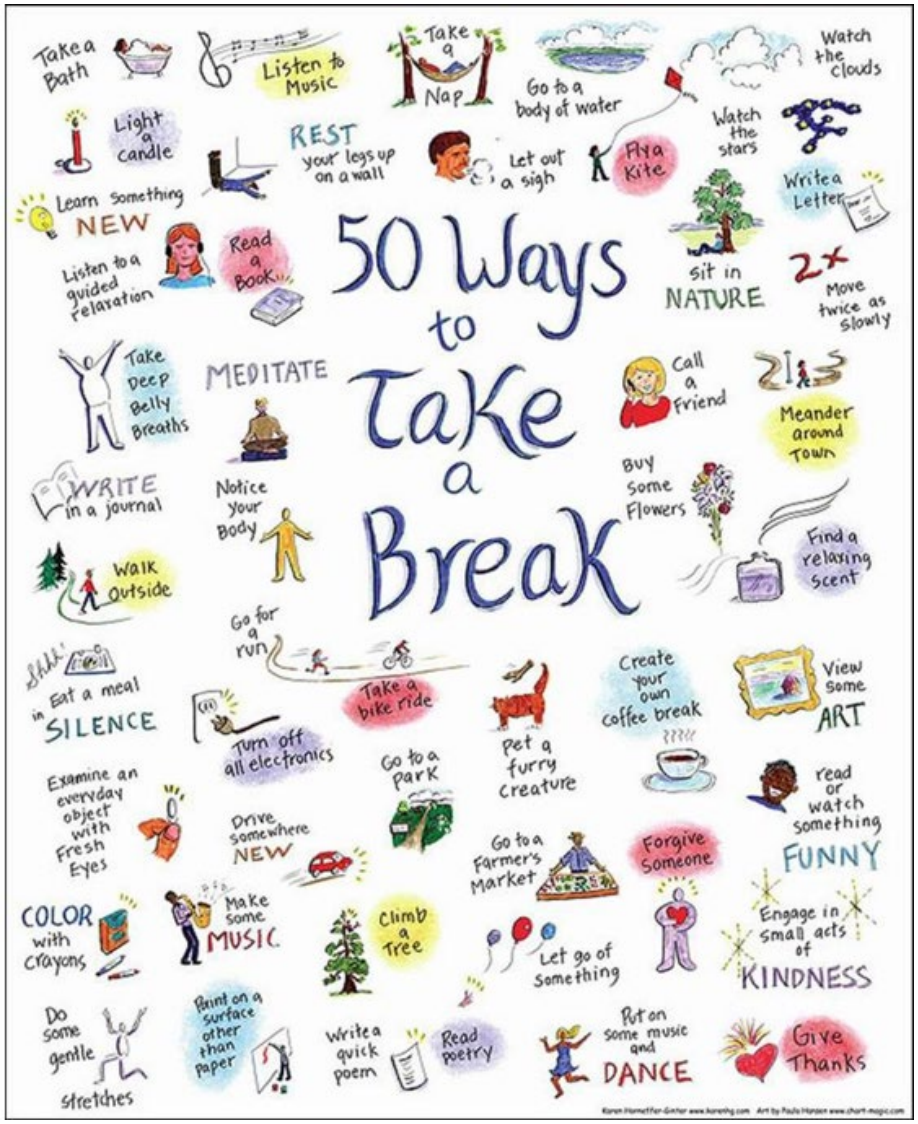
What determines which pattern a pt will manifest?
The *order* of the Horners, ie, whether s/he has a **first-**, **second-**, or **third-order Horner syndrome**

third—
're unsure
hortly.)

Horner Syndrome

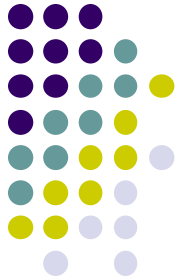


Harlequin syndrome in Horners (note the attendant ptosis and miosis)



(This is a good point in the set to take a break)

Horner Syndrome



Next we will embark on an extensive review of both the sympathetic and parasympathetic pathways as they relate to the eye/orbit. Get comfy—this will take a while!

Horner Syndrome

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 structure

Second-order neurons

Third-order neurons

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 one word and two words

Second-order neurons

Third-order neurons

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons

--Originate in hypothalamus

--Travel in brainstem and spinal cord

Second-order neurons

Third-order neurons

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons

--Originate in hypothalamus

--Travel in **brainstem** and spinal cord

As they traverse the brainstem, the first-order fibers pass near the nucleus of a cranial nerve involved in extraocular motility. Which one?

Second-order neurons

Third-order neurons

Horner Syndrome

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

Second-order neurons

As they traverse the brainstem, the first-order fibers pass near the nucleus of a cranial nerve involved in extraocular motility. Which one?
CN4

Third-order neurons

Horner Syndrome

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

Second-order neurons

As they traverse the brainstem, the first-order fibers pass near the nucleus of a cranial nerve involved in extraocular motility. Which one?
CN4

Can a brainstem lesion bag both structures (ie, the CN4 nucleus and the first-order sympathetic fibers) simultaneously?

Third-order neurons

Horner Syndrome

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

Second-order neurons

As they traverse the brainstem, the first-order fibers pass near the nucleus of a cranial nerve involved in extraocular motility. Which one?
CN4

Can a brainstem lesion bag both structures (ie, the CN4 nucleus and the first-order sympathetic fibers) simultaneously?
Indeed it can

Third-order neurons

Horner Syndrome

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

Second-order neurons

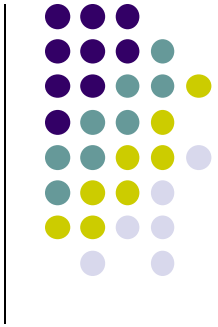
As they traverse the brainstem, the first-order fibers pass near the nucleus of a cranial nerve involved in extraocular motility. Which one?
CN4

Can a brainstem lesion bag both structures (ie, the CN4 nucleus and the first-order sympathetic fibers) simultaneously?
Indeed it can

How would such a lesion present clinically?

Third-order neurons

Horner Syndrome



Neural pathway in Horner syndrome:

First-order neurons

--Originate in hypothalamus

--Travel in **brainstem** and spinal cord

Second-order neurons

As they traverse the brainstem, the first-order fibers pass near the nucleus of a cranial nerve involved in extraocular motility. Which one?

CN4

Can a brainstem lesion bag both structures (ie, the CN4 nucleus and the first-order sympathetic fibers) simultaneously?

Indeed it can

Third-order neurons

How would such a lesion present clinically?

With a Horner syndrome ipsi- vs contralateral to the lesion and a SO palsy ipsi- vs contralateral to the lesion

Horner Syndrome

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

Second-order neurons

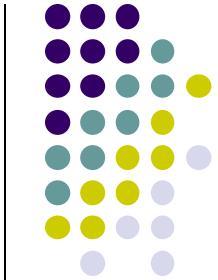
As they traverse the brainstem, the first-order fibers pass near the nucleus of a cranial nerve involved in extraocular motility. Which one?
CN4

Can a brainstem lesion bag both structures (ie, the CN4 nucleus and the first-order sympathetic fibers) simultaneously?
Indeed it can

Third-order neurons

How would such a lesion present clinically?
With a Horner syndrome ipsilateral to the lesion and a SO palsy contralateral to the lesion

Horner Syndrome



Neural pathway in Horner syndrome:

First-order neurons

--Originate in hypothalamus

--Travel in **brainstem** and spinal cord

Second-order neurons

As they traverse the brainstem, the first-order fibers pass near the nucleus of a cranial nerve involved in extraocular motility. Which one?

CN4

Can a brainstem lesion bag both structures (ie, the CN4 nucleus and the first-order sympathetic fibers) simultaneously?

Indeed it can

Third-order neurons

How would such a lesion present clinically?

With a Horner syndrome ipsilateral to the lesion and a SO palsy **contralateral** to the lesion

Why would the SO palsy be contralateral to the lesion?

Horner Syndrome

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

Second-order neurons

As they traverse the brainstem, the first-order fibers pass near the nucleus of a cranial nerve involved in extraocular motility. Which one?
CN4

Can a brainstem lesion bag both structures (ie, the CN4 nucleus and the first-order sympathetic fibers) simultaneously?
Indeed it can

Third-order neurons

How would such a lesion present clinically?
With a Horner syndrome ipsilateral to the lesion and a SO palsy **contralateral** to the lesion

Why would the SO palsy be contralateral to the lesion?
Because control of the SOs is crossed, ie, the *right* SO muscle is controlled by the *left* SO nucleus, and vice versa

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons

--Originate in hypothalamus

--Travel in brainstem and spinal cord

--Synapse in the four words

Second-order neurons

Third-order neurons

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons

--Originate in hypothalamus

--Travel in brainstem and spinal cord

--Synapse in the 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 brainstem and spinal cord

--Synapse in **the ciliospinal center of Budge**

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

Second-order neurons

Third-order neurons

Horner Syndrome

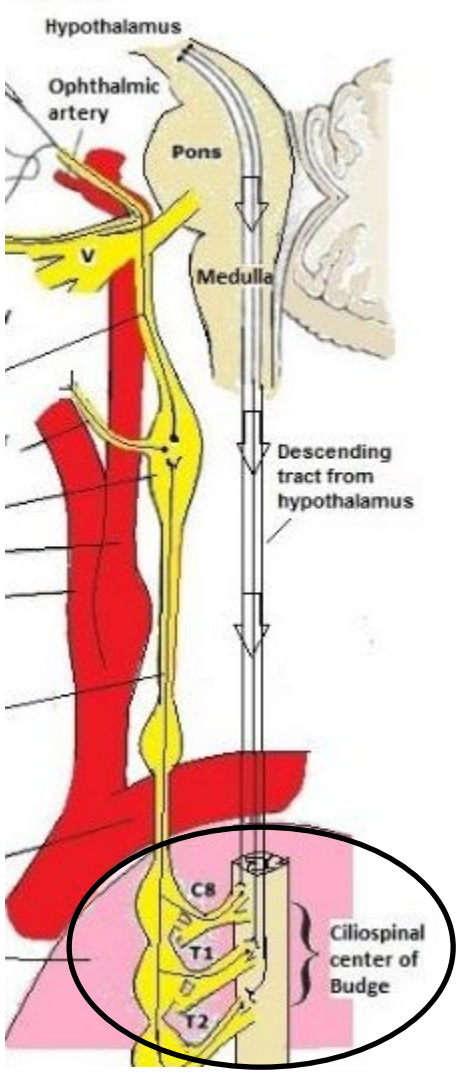
Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in brainstem and spinal cord
--Synapse in **the ciliospinal center of Budge**

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

Second-order neurons

Third-order neurons

Horner Syndrome



Müller's muscle

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons

--Originate in hypothalamus

--Travel in brainstem and spinal cord

--Synapse in the ciliospinal center of Budge

Second-order neurons

--Originate at Budge center

--Exit two words

Third-order neurons

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons

--Originate in hypothalamus

--Travel in brainstem and spinal cord

--Synapse in the ciliospinal 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 brainstem and spinal cord

--Synapse in the 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 brainstem and spinal cord

--Synapse in the 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 brainstem and spinal cord
--Synapse in the ciliospinal center of Budge

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

What major structure do these fibers pass over?

Third-order neurons

Horner Syndrome

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

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

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

Third-order neurons

Horner Syndrome

Neural pathway in Horner syndrome:

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

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

What major structure do these fibers pass over?

The lung apex

Foreshadowing alert!

Third-order neurons

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons

--Originate in hypothalamus

--Travel in brainstem and 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 three words

Third-order neurons

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons

--Originate in hypothalamus

--Travel in brainstem and spinal cord

--Synapse in the ciliospinal center of Budge

Second-order neurons

--Originate at Budge center

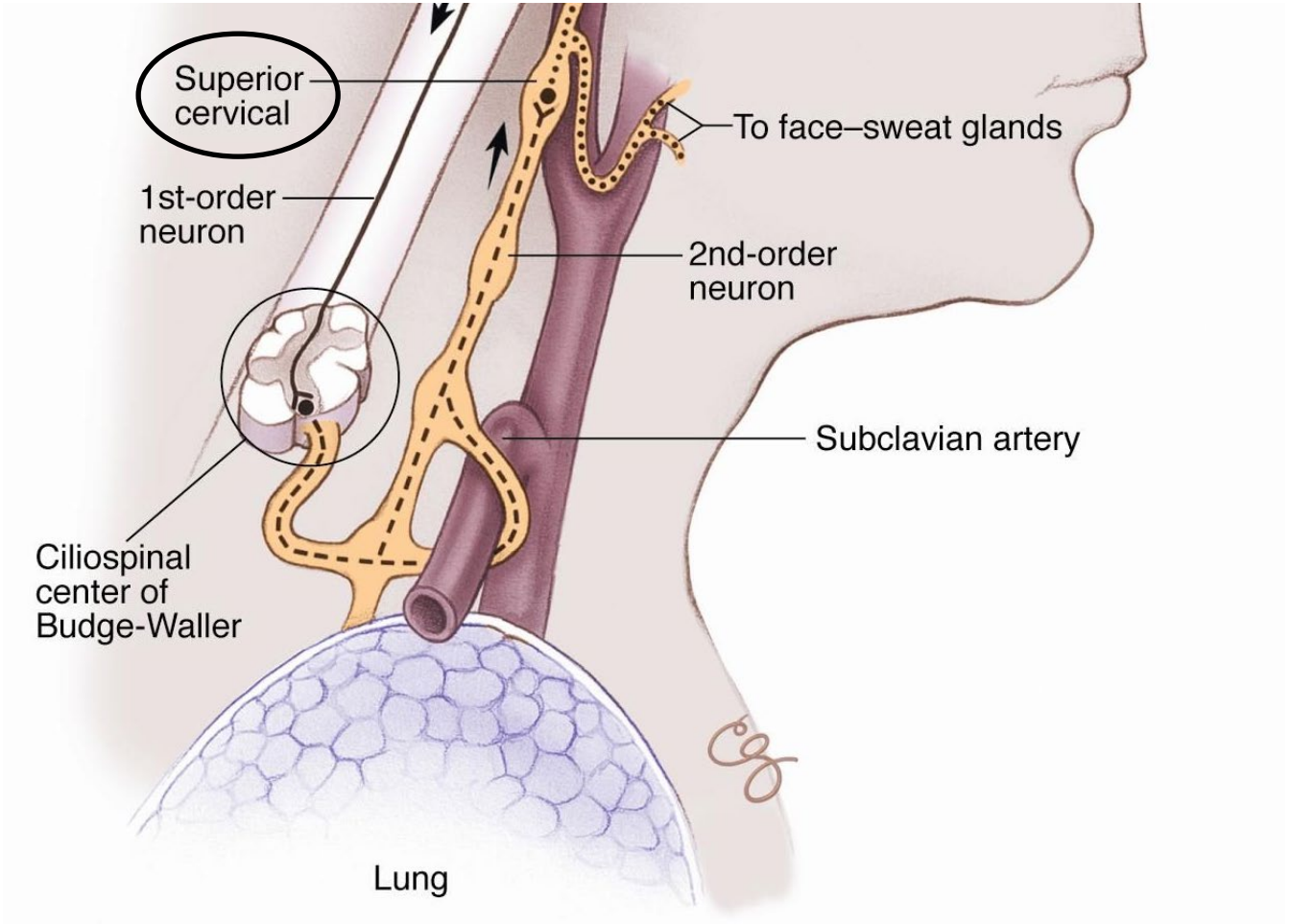
--Exit spinal cord

--Travel in sympathetic chain

--Synapse in superior cervical ganglion

Third-order neurons

Horner Syndrome



Sympathetic pathway: 2nd order neuron

Horner Syndrome

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

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

What neurotransmitter is found in this synapse?

Third-order neurons

Horner Syndrome

Neural pathway in Horner syndrome:

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

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

What neurotransmitter is found in this synapse?
Acetylcholine (ACh)

Third-order neurons

Horner Syndrome

Neural pathway in Horner syndrome:

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

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

What neurotransmitter is found in this synapse?
Acetylcholine (ACh)

Third-order neurons

ACh receptors come in two flavors based on their responsiveness to specific chemicals. What are these two flavors?

Horner Syndrome

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

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

What neurotransmitter is found in this synapse?
Acetylcholine (ACh)

Third-order neurons

ACh receptors come in two flavors based on their responsiveness to specific chemicals. What are these two flavors?
Muscarinic and nicotinic

Horner Syndrome

Neural pathway in Horner syndrome:

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

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

What neurotransmitter is found in this synapse?
Acetylcholine (ACh)

Third-order neurons

ACh receptors come in two flavors based on their responsiveness to specific chemicals. What are these two flavors?
Muscarinic and nicotinic

Is this synapse muscarinic, or nicotinic?

Horner Syndrome

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

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

What neurotransmitter is found in this synapse?
Acetylcholine (ACh)

Third-order neurons

ACh receptors come in two flavors based on their responsiveness to specific chemicals. What are these two flavors?
Muscarinic and nicotinic

Is this synapse muscarinic, or nicotinic?
Nicotinic

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons

--Originate in hypothalamus

--Travel in brainstem and spinal cord

--Synapse in the ciliospinal center of Budge

Second-order neurons *aka...pre-ganglionic neurons*

--Originate at Budge center

--Exit spinal cord

--Travel in sympathetic chain

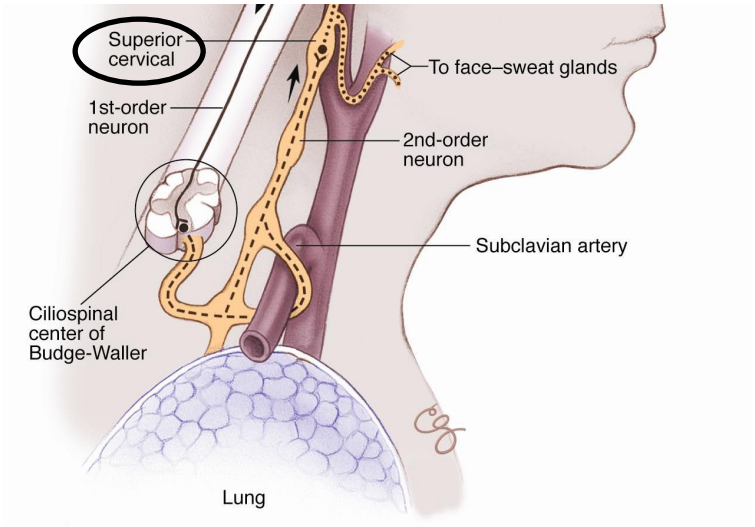
--Synapse in superior cervical ganglion *aka...the stellate ganglion*

Third-order neurons

--**Originate in superior cervical ganglion**

(No question—proceed when ready)

Horner Syndrome



Sympathetic pathway: 3rd order neuron

Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in brainstem and spinal cord
--Synapse in the 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 brainstem and spinal cord
--Synapse in the 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 brainstem and spinal cord

--Synapse in the ciliospinal center of Budge

Second-order neurons *aka...pre-ganglionic neurons*

--Originate at Budge center

--Exit spinal cord

--Travel in sympathetic chain

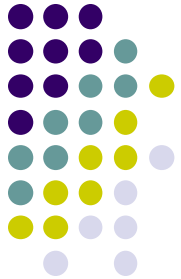
--Synapse in superior cervical ganglion *aka...the stellate ganglion*

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 brainstem and spinal cord

--Synapse in the ciliospinal center of Budge

Second-order neurons *aka...pre-ganglionic neurons*

--Originate at Budge center

--Exit spinal cord

--Travel in sympathetic chain

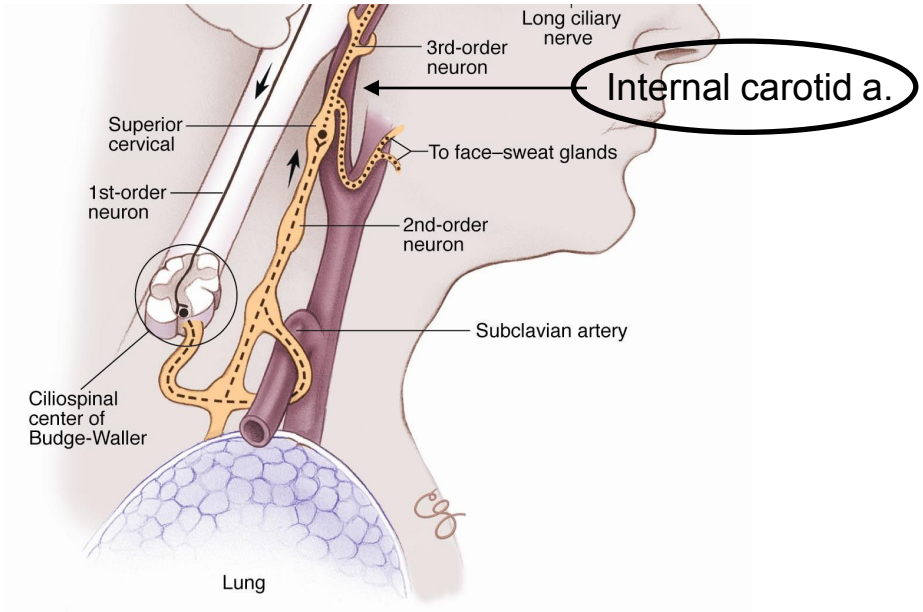
--Synapse in superior cervical ganglion *aka...the stellate ganglion*

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

--Originate in superior cervical ganglion

--Travel with internal carotid artery to enter the cavernous sinus

Horner Syndrome



Sympathetic pathway: 3rd order neuron

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons

--Originate in hypothalamus

--Travel in brainstem and spinal cord

--Synapse in the 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*

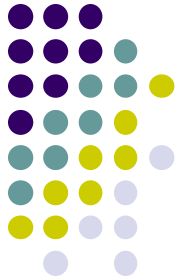
--Originate in superior cervical ganglion

--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 brainstem and spinal cord

--Synapse in the 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*

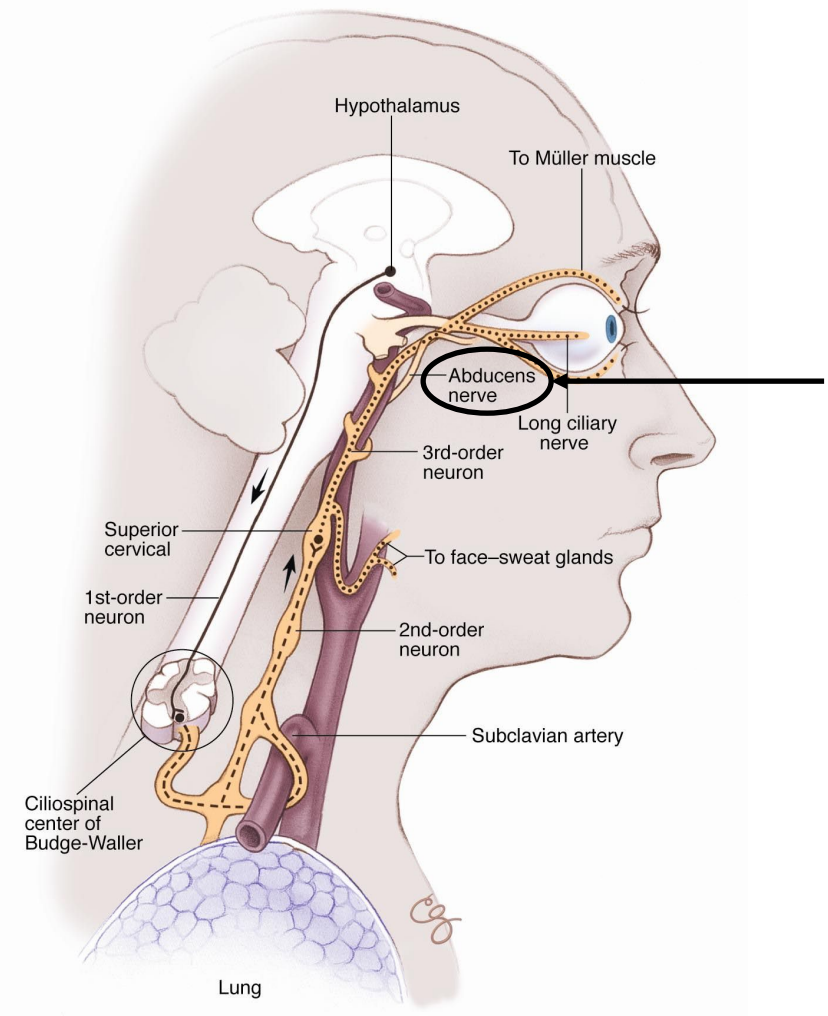
--Originate in superior cervical ganglion

--Travel with internal carotid artery to enter the cavernous sinus

--In the sinus:

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

Horner Syndrome



Sympathetic pathway: 3rd order neuron

Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in brainstem and spinal cord
--Synapse in the 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?

----**Fibers bound for the pupil join CN6** , then V1

Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in brainstem and spinal cord
--Synapse in the 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

--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 brainstem and spinal cord
--Synapse in the 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 brainstem and spinal cord
--Synapse in the 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!

--In the sinus:
----**Fibers bound for the pupil join CN6** , then V1

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons

--Origina

--Travel i

--Synaps

Second-o

--Origina

--Exit spi

--Travel i

--Synaps

Third-ord

--Origina

--Travel v

--In the sinus:

----Fibers bound for the pupil join CN6 , **then V1**

V1 (aka the [redacted] nerve*)*

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons

--Origina

--Travel i

--Synaps

Second-o

--Origina

--Exit spi

--Travel i

--Synaps

Third-ord

--Origina

--Travel v

--In the sinus.

----Fibers bound for the pupil join CN6 , **then V1**

V1 (aka the ophthalmic nerve*)*

Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Origina
--Travel i
--Synaps

Second-o
--Origina
--Exit spi
--Travel i
--Synaps

Third-ord
--Origina
--Travel v
--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

--Origina

--Travel i

--Synaps

Second-o

--Origina

--Exit spi

--Travel i

--Synaps

Third-ord

--Origina

--Travel v

--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

--Origina

--Travel i

--Synaps

Second-o

--Origina

--Exit spi

--Travel i

--Synaps

Third-ord

--Origina

--Travel v

--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…

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons

--Origina

--Travel i

--Synaps

Second-o

--Origina

--Exit spi

--Travel i

--Synaps

Third-ord

--Origina

--Travel v

--In the sinus.

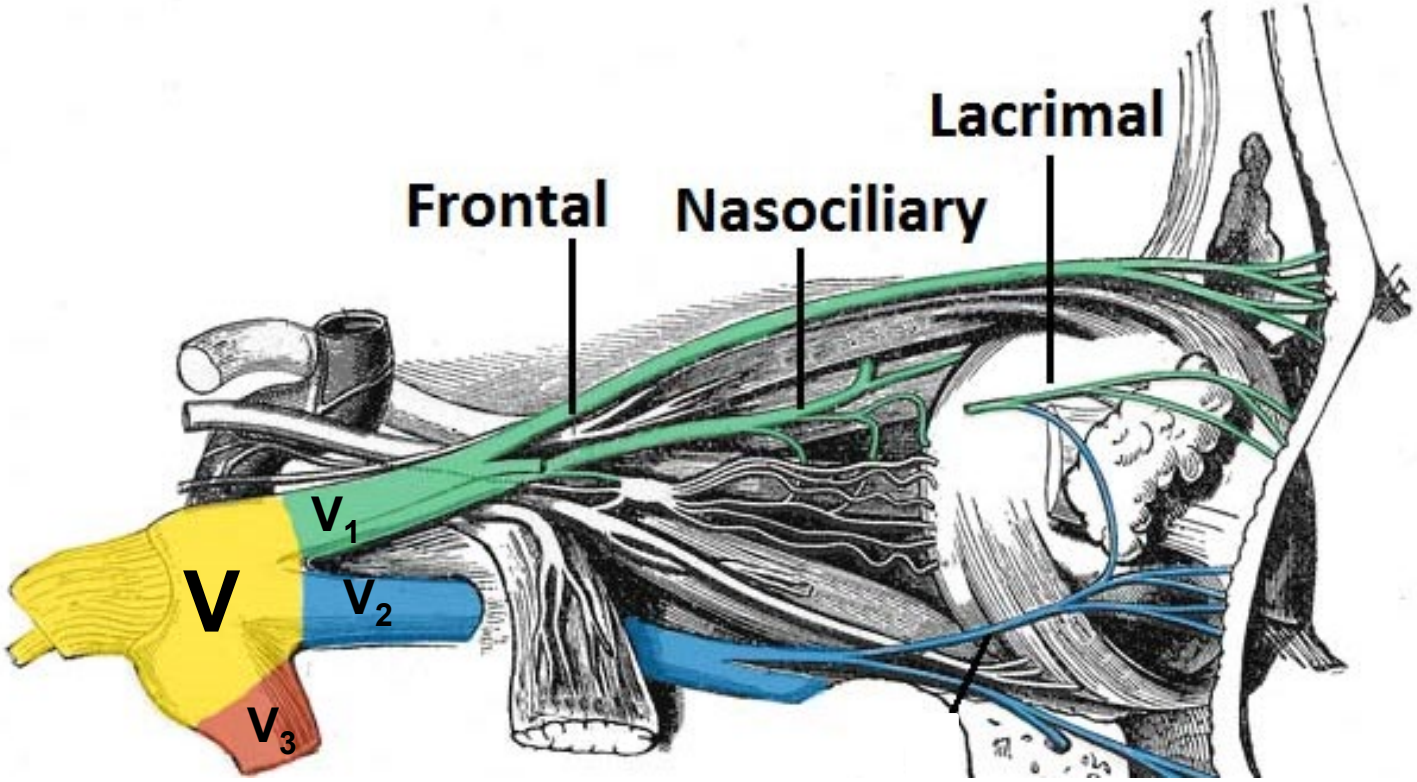
----Fibers bound for the pupil join CN6 , **then V1**

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

--**N**asociliary
--**F**rontal
--**L**acrimal

Mnemonic forthcoming…

Horner Syndrome



Ophthalmic nerve (V_1)

Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Origina
--Travel i
--Synaps

Second-o
--Origina
--Exit spi
--Travel i
--Synaps

Third-ord
--Origina
--Travel v
--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**asociliary
--**F**rontal
--**L**acrimal

With which branch do the postganglionic sympathetics run?

Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Origina
--Travel i
--Synaps

Second-o
--Origina
--Exit spi
--Travel i
--Synaps

Third-ord
--Origina
--Travel v
--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**asociliary
--**F**rontal
--**L**acrimal

With which branch do the postganglionic sympathetics run?
The nasociliary

Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Origina
--Travel i
--Synaps

Second-o
--Origina
--Exit spi
--Travel i
--Synaps

Third-ord
--Origina
--Travel v
--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**asociliary
--**F**rontal
--**L**acrimal

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
--Origina
--Travel i
--Synaps

Second-o
--Origina
--Exit spi
--Travel i
--Synaps

Third-ord
--Origina
--Travel v
--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**asociliary
--**F**rontal
--**L**acrimal

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
--Origina
--Travel i
--Synaps

Second-o
--Origina
--Exit spi
--Travel i
--Synaps

--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**asociliary
--**F**rontal
--**L**acrimal

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?

Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Origina
--Travel i
--Synaps

Second-o
--Origina
--Exit spi
--Travel i
--Synaps

--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**asociliary
--**F**rontal
--**L**acrimal

*With which branch do the **post**ganglionic 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 **post**ganglionic sympathetics.
They will pass through the ganglion without synapsing.

Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Origina
--Travel i
--Synaps

Second-o
--Origina
--Exit spi
--Travel i
--Synaps

Third-ord
--Origina
--Travel v
--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**asociliary
--**F**rontal
--**L**acrimal

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?

Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Origina
--Travel i
--Synaps

Second-o
--Origina
--Exit spi
--Travel i
--Synaps

Third-ord
--Origina
--Travel v
--In the sinus.
----Fibers bound for the pupil join CN6 , **then V1**

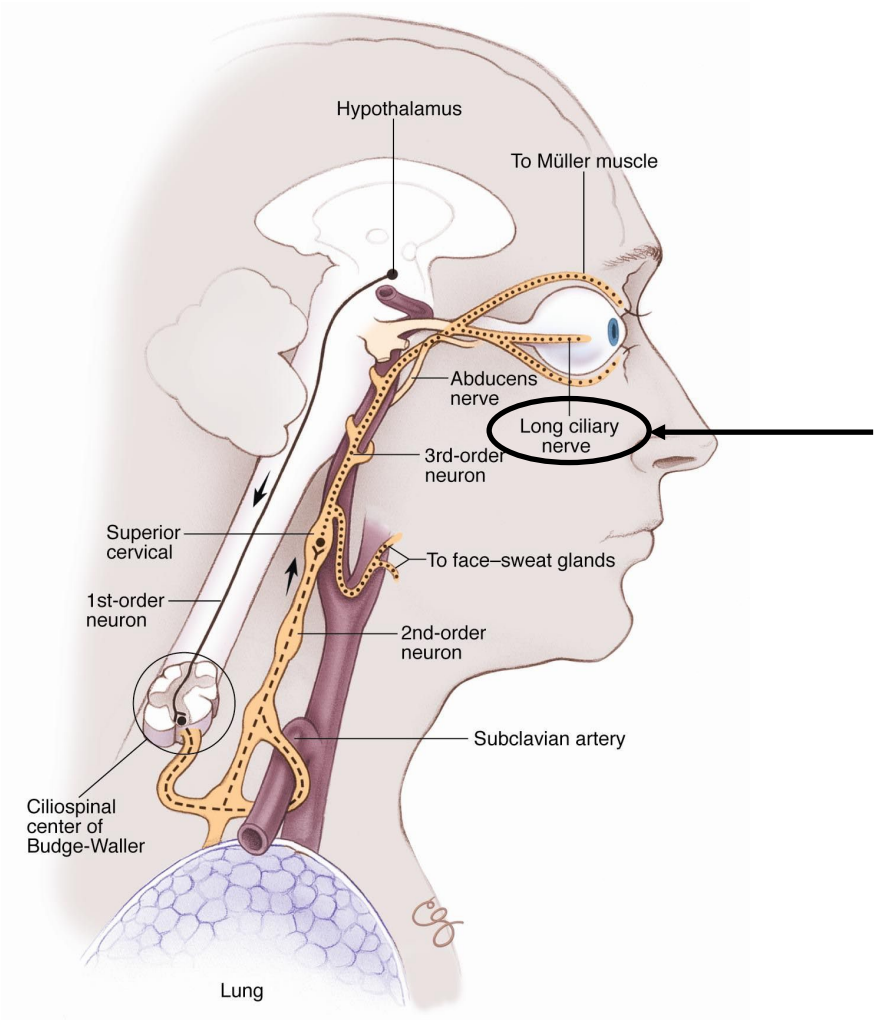
V1 (aka the ophthalmic nerve*) breaks into three branches. What are they?*
--**N**asociliary
--**F**rontal
--**L**acrimal

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



Sympathetic pathway: 3rd order neuron

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons

--Originate in hypothalamus

--Travel in brainstem and spinal cord

--Synapse in the 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

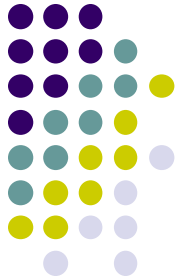
--In the sinus:

----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 brainstem and spinal cord

--Synapse in the 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

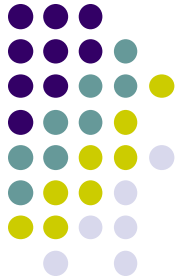
--In the sinus:

----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 _____ and _____ branches

Horner Syndrome



Neural pathway in Horner syndrome:

First-order neurons

--Originate in hypothalamus

--Travel in brainstem and spinal cord

--Synapse in the 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

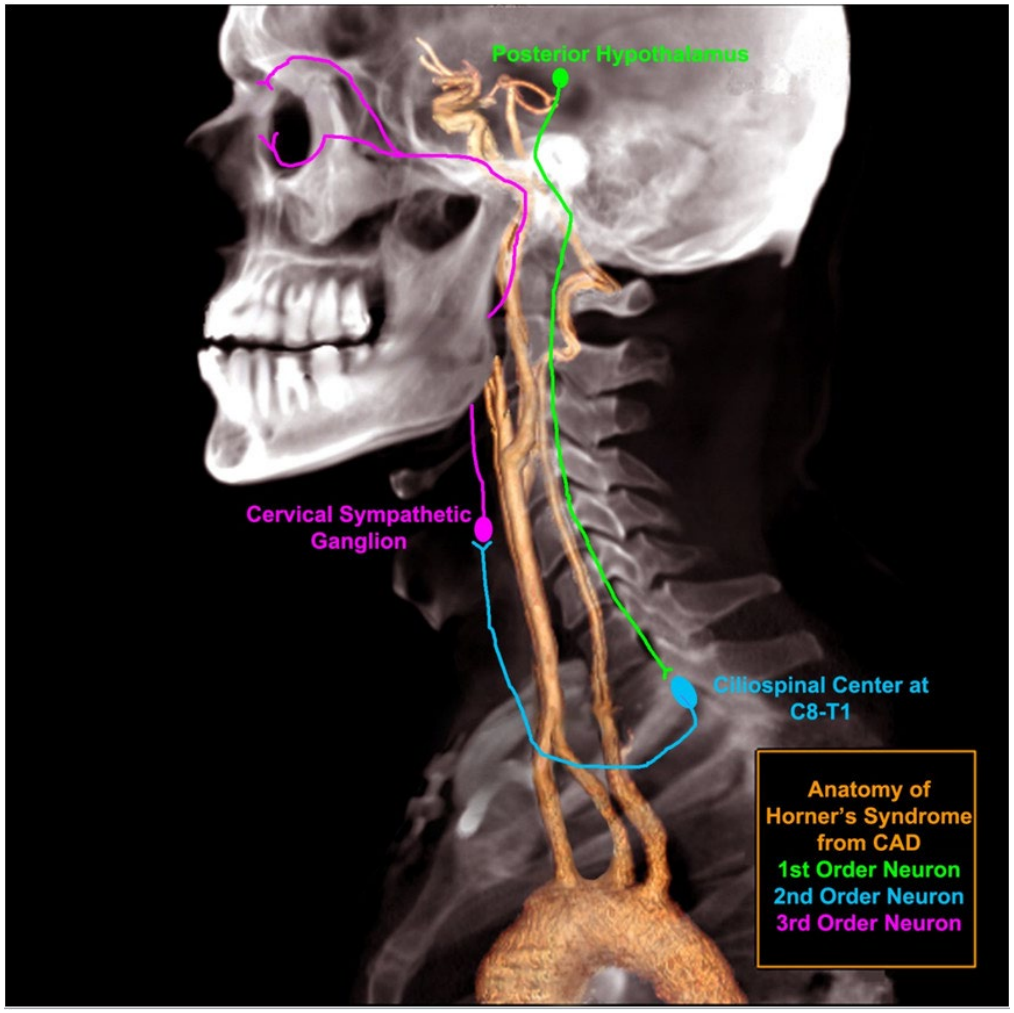
--In the sinus:

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

----Fibers bound for Mueller's muscle, as well as…

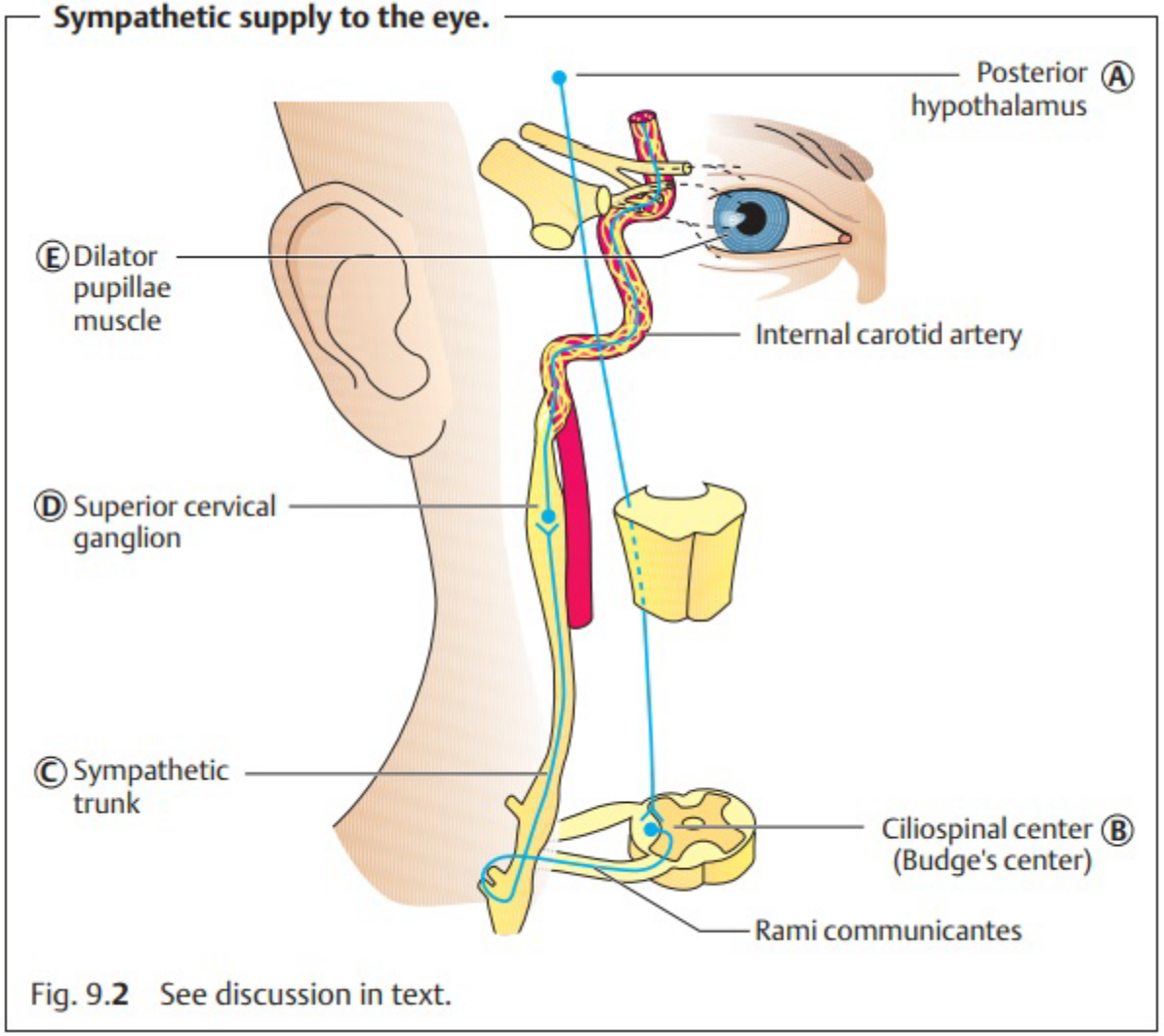
----Fibers bound for sweat glands of the forehead hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches

Horner Syndrome



Sympathetic pathway overview

Horner Syndrome



Sympathetic pathway overview

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons
--Originate in hypothalamus
--Travel in brainstem and 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** *stellate ganglion*

Recall that the NT at this synapse was abb.

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

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in brainstem and 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** *stellate ganglion*

Recall that the NT at this synapse was ACh

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

Neural pathway in Horner syndrome:

First-order neurons
--Originate in hypothalamus
--Travel in brainstem and 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** *stellate ganglion*

Recall that the NT at this synapse was ACh, specifically of the remember? subtype

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

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in brainstem and 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** *stellate ganglion*

Recall that the NT at this synapse was ACh, specifically of the nicotinic subtype

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

Neural pathway in Horner syndrome:

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

What about the synapse between the 3rd order neuron and the effector organ—is it ACh as well?

--Exit spinal cord
--Travel in sympathetic chain
--**Synapse** in stellate ganglion

Recall that the NT at this synapse was ACh, specifically of the nicotinic subtype

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

Neural pathway in Horner syndrome:

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

What about the synapse between the 3rd order neuron and the effector organ—is it ACh as well?
No, it is

--Exit spinal cord
--Travel in sympathetic chain
--**Synapse** in superior cervical ganglion

Recall that the NT at this synapse was ACh, specifically of the nicotinic subtype

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

Neural pathway in Horner syndrome:

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

What about the synapse between the 3rd order neuron and the effector organ—is it ACh as well?
No, it is norepinephrine

--Exit spinal cord
--Travel in sympathetic chain
--**Synapse** in stellate ganglion

Recall that the NT at this synapse was ACh, specifically of the nicotinic subtype

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

*Hol up—we never talked about the NT at **this** synapse. What is it?*

--Travel in brainstem and spinal cord
--**Synapse**

What about the synapse between the 3rd order neuron and the effe[illegible] organ—is it ACh as well?
No, it is norepinephrine

--Exit spinal cord
--Travel in sym[illegible]athetic chain
--**Synapse** [illegible]ate ganglion

Recall that the NT at this synapse was ACh, specifically of the nicotinic subtype

Third-order neurons *aka...post-ganglionic neur[illegible]s*
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the caver[illegible]us 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 th[illegible] forehead hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches

Horner Syndrome

*Hol up—we never talked about the NT at **this** synapse. What is it?*
I dunno. More importantly, it's not addressed in any of the *BCSC* books, so fuggedaboudit.

--Travel in brainstem and spinal cord
--**Synapse**

What about the synapse between the 3rd order neuron and the effe[illegible]r organ—is it ACh as well?
No, it is norepinephrine

--Exit spinal cord
--Travel in sym[illegible]athetic chain
--**Synapse** [illegible]st[illegible]ate ganglion

Recall that the NT at this synapse was ACh, specifically of the nicotinic subtype

Third-order neurons *aka...post-ganglionic neur[illegible]s*
--Originate in superior cervical ganglion
--Travel with internal carotid artery to enter the caver[illegible]us 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 th[illegible] 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 brainstem and spinal cord
--Synapse in the 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

----Fibers bound for sweat glands of the ~~forehead~~ *rest of the face* 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 brainstem and spinal cord
--Synapse in the 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*
--
--
--
--
----Fibers bound for Mueller's muscle, as well as
----Fibers bound for sweat glands of the ~~forehead~~ *rest of the face* hop onto the ophthalmic artery, and then onto its frontal and lacrimal branches

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

Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in brainstem and spinal cord
--Synapse in the 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?

--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 brainstem and spinal cord
--Synapse in the 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 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 brainstem and spinal cord
--Synapse in the 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 'belong' to which cranial nerve?

artery, and then c

--Fibers boun

Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in brainstem and spinal cord
--Synapse in the 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 'belong' to which cranial nerve?
CN7

artery, and then
--Fibers boun

Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in brainstem and spinal cord
--Synapse in the 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?

Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in brainstem and spinal cord
--Synapse in the 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

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons
--Originate in hypothalamus
--Travel in brainstem and spinal cord
--Synapse in the 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?*

preganglionic parasympathetic fibers on their way to innervate the gland

almic

These preganglionic parasympathetic fibers form a named nerve—what is its name? *ranial nerve?*

The greater petrosal nerve

Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in brainstem and spinal cord
--Synapse in the 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

preganglionic parasympathetic fibers on their way to innervate the gland

almic

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

ranial nerve?

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons
--Originate in hypothalamus
--Travel in brainstem and spinal cord
--Synapse in the 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 t

These postganglionic sympathet

The deep petrosal nerve

preganglionic parasympathetic fibers on their way to innervate the gland

almic

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

+ = ?

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

ranial nerve?

The greater petrosal nerve

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons
--Originate in hypothalamus
--Travel in brainstem and spinal cord
--Synapse in the 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 t

These postganglionic sympathet

The deep petrosal nerve

preganglionic parasympathetic fibers on their way to innervate the gland

almic

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

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

+ = The vidian nerve

Horner Syndrome

Neural pathway in Horner syndrome:
First-order neurons
--Originate in hypothalamus
--Travel in brainstem and spinal cord
--Synapse in the 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 caroti

What about fibers bound for t

These postganglionic sympathet

The deep petrosal nerve

preganglionic parasympathetic fibers on their way to innervate the gland

almic

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

The greater petrosal nerve

cranial nerve?

By what passage does the vidian nerve exit the skull?

p,

they form a new named nerve--what is its name?

The vidian nerve *aka...*

+ = **The vidian nerve**

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons
--Originate in hypothalamus
--Travel in brainstem and spinal cord
--Synapse in the 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 caroti

What about fibers bound for t

These postganglionic sympathet

The deep petrosal nerve

preganglionic parasympathetic fibers on their way to innervate the gland

+ = **The vidian nerve**

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

they form a new named nerve--what is its name?
The vidian nerve *aka...the nerve of the vidian canal*

almic

cranial nerve?

Horner Syndrome

Neural pathway in Horner syndrome:

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

Second-order neurons *aka...pre-ganglionic neurons*
--Originate at Budge cente
--Exit spinal cord
--Travel in sympathetic ch
--Synapse in superior cerv

Third-order neurons *aka*
--Originate in superior cervical ganglion
--Travel with internal caroti

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

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

What about fibers bound for t *p,*
they form a ***new*** *named nerve--what is its name?*
The vidian nerve *aka...the nerve of the vidian canal*

These postganglionic sympathet
The deep petrosal nerve
preganglionic parasympathetic fibers on their way to innervate the gland

almic

+ = The vidian nerve

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

Horner Syndrome

Neural pathway in Horner syndrome:

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

Second-order neurons *aka...pre-ganglionic neurons*
--Originate at Budge cente
--Exit spinal cord
--Travel in sympathetic ch
--Synapse in superior cerv

Third-order neurons *aka*
--Originate in superior cervical ganglion
--Travel with internal caroti

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

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

What about fibers bound for t *p,*
they form a ***new*** *named nerve--what is its name?*
The vidian nerve *aka...the nerve of the vidian canal*

These postganglionic sympathet
The deep petrosal nerve
preganglionic parasympathetic fibers on their way to innervate the gland

almic

+ = The vidian nerve

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

Horner Syndrome

Neural pathway in Horner syndrome:

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

Second-order neurons *aka...pre-ganglionic neurons*
--Originate at Budge cente
--Exit spinal cord
--Travel in sympathetic ch
--Synapse in superior cerv

Third-order neurons *aka*
--Originate in superior cervical ganglion
--Travel with internal caroti

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

Will the sympathetic fibers synapse in the pterygopalatine ganglion?

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

What about fibers bound for t *p,*
they form a ***new*** *named nerve--what is its name?*
The vidian nerve *aka...the nerve of the vidian canal*

These postganglionic sympathet
The deep petrosal nerve
preganglionic parasympathetic fibers on their way to innervate the gland

almic

+ = The vidian nerve

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

Horner Syndrome

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

Second-order neurons *aka...pre-ganglionic neurons*
--Originate at Budge cente
--Exit spinal cord
--Travel in sympathetic ch
--Synapse in superior cerv

Third-order neurons *aka*
--Originate in superior cervical ganglion
--Travel with internal caroti

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 **post**ganglionic, 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

What about fibers bound for t *p,*
they form a ***new*** *named nerve--what is its name?*
The vidian nerve *aka...the nerve of the vidian canal*

These postganglionic sympathet
The deep petrosal nerve
preganglionic parasympathetic fibers on their way to innervate the gland
almic

+ = **The vidian nerve**

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

Horner Syndrome

Neural pathway in Horner syndrome:

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

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

Second-order neurons *aka...pre-ganglionic neurons*
--Originate at Budge cente
--Exit spinal cord
--Travel in sympathetic ch
--Synapse in superior cerv

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 **post**ganglionic, and will pass through the ganglion without synapsing. Only the preganglionic parasympathetics will synapse in the pterygopalatine ganglion.

Third-order neurons *aka*
--Originate in superior cervical ganglion
--Travel with internal caroti

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

What about fibers bound for t *p,*
*they form a **new** named nerve--what is its name?*
The vidian nerve *aka...the nerve of the vidian canal*

These postganglionic sympathet
The deep petrosal nerve

preganglionic parasympathetic fibers on their way to innervate the gland

almic

+ = **The vidian nerve**

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

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons

--Originate in hypothalamus

--Travel in brainstem and spinal cord

--

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

They will pass through the [redacted] orbital fissure to join the [redacted] nerve on its way to the gland

Second-order neurons *aka...pre-ganglionic neurons*

--Originate at Budge cente

--Exit spinal cord

--Travel in sympathetic ch

--Synapse in superior cerv

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 **post**ganglionic, and will pass through the ganglion without synapsing. Only the preganglionic parasympathetics will synapse in the pterygopalatine ganglion.

Third-order neurons *aka*

--Originate in superior cervical ganglion

--Travel with internal caroti

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

The vidian canal

What about fibers bound for t *p,*

*they form a **new** named nerve--what is its name?*

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

These postganglionic sympathet

The deep petrosal nerve

preganglionic parasympathetic fibers on their way to innervate the gland

almic

+ = **The vidian nerve**

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

The greater petrosal nerve

Horner Syndrome

Neural pathway in Horner syndrome:

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

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

Second-order neurons *aka...pre-ganglionic neurons*
--Originate at Budge cente
--Exit spinal cord
--Travel in sympathetic ch
--Synapse in superior cerv

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 **post**ganglionic, and will pass through the ganglion without synapsing. Only the preganglionic parasympathetics will synapse in the pterygopalatine ganglion.

Third-order neurons *aka*
--Originate in superior cervical ganglion
--Travel with internal caroti

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

What about fibers bound for t *p,*
*they form a **new** named nerve--what is its name?*
The vidian nerve *aka...the nerve of the vidian canal*

These postganglionic sympathet
The deep petrosal nerve
preganglionic parasympathetic fibers on their way to innervate the gland
almic

+ = The vidian nerve

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

Horner Syndrome

Neural pathway in Horner syndrome:

First-order neurons

--Originate in hypothalamus

--Travel in brainstem and spinal cord

--

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

Speaking of parasympathetics: Let's review its pathway systematically, the way we did the sympathetic one…

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

Third-order neurons *aka*

--Originate in superior cervical ganglion

--Travel with internal caroti

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

The vidian canal

What about fibers bound for t

*they form a **new** named nerve--what is its name?*

The vidian nerve *aka…the nerve of the vidian canal*

These postganglionic sympathet

The deep petrosal nerve

preganglionic parasympathetic fibers on their way to innervate the gland

almic

+ = **The vidian nerve**

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

cranial nerve?

The greater petrosal nerve

Horner Syndrome

***Parasympathetic* pathway:**
First-order neurons?

Second-order neurons?

Third-order neurons?

Speaking of: *Is the parasympathetic pathway similarly divided into 1st, 2nd and 3rd order neurons?*

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

Second-order neurons?

Third-order neurons?

Speaking of: *Is the parasympathetic pathway similarly divided into 1st, 2nd and 3rd order neurons?*
No. The 'top' inputs that influence parasympathetic innervation of the pupil are widely distributed, and cannot reasonably be conceptualized as a unitary 'first-order neuron.' (Note: I made up the term 'top inputs' for illustrative purposes; it is not used in practice.)

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

~~Second-order neurons~~

~~Third-order neurons~~

Speaking of: *Is the parasympathetic pathway similarly divided into 1st, 2nd and 3rd order neurons?*
No. The 'top' inputs that influence parasympathetic innervation of the pupil are widely distributed, and cannot reasonably be conceptualized as a unitary 'first-order neuron.' (Note: I made up the term 'top inputs' for illustrative purposes; it is not used in practice.) It follows that if there are no 1st-order neurons, the terms *second-* and *third-order neurons* are not applicable.

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

Pre-ganglionic neurons

~~Second-order neurons~~

Post-ganglionic neurons

~~Third-order neurons~~

Speaking of: *Is the parasympathetic pathway similarly divided into 1st, 2nd and 3rd order neurons?*
No. The 'top' inputs that influence parasympathetic innervation of the pupil are widely distributed, and cannot reasonably be conceptualized as a unitary 'first-order neuron.' (Note: I made up the term 'top inputs' for illustrative purposes; it is not used in practice.) It follows that if there are no 1st-order neurons, the terms *second-* and *third-order neurons* are not applicable. **For this reason, *pre-* and *post-ganglionic* are the preferred terms for these neurons.**

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate (mainly) in the two words

Pre-ganglionic neurons

~~Second-order neurons~~

Post-ganglionic neurons

~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate (mainly) in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

Post-ganglionic neurons

~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate (mainly) in the **pretectal nuclei**

Where are the pretectal nuclei located?

Pre-ga

~~Second~~

Post-ganglionic neurons

~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate (mainly) in the **pretectal nuclei**

Where are the pretectal nuclei located?

The dorsal midbrain

~~Pre-ga~~

~~Second~~

~~Post-ganglionic neurons~~

~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate (mainly) in the **pretectal nuclei**

Where are the pretectal nuclei located?
The dorsal midbrain

Damage to the pretectal nuclei of the dorsal midbrain produces what eponymous syndrome?

~~Pre-ga~~
~~Second~~

Post-ganglionic neurons
~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' ~~inputs~~

--Originate (mainly) in the **pretectal nuclei**

Where are the pretectal nuclei located?
The dorsal midbrain

Damage to the pretectal nuclei of the dorsal midbrain produces what eponymous syndrome?
Parinaud syndrome (aka [two words] syndrome, aka [ ] syndrome)

Pre-ga
~~Second~~

Post-ganglionic neurons
~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate (mainly) in the **pretectal nuclei**

Where are the pretectal nuclei located?
The dorsal midbrain

Damage to the pretectal nuclei of the dorsal midbrain produces what eponymous syndrome?
Parinaud syndrome (aka dorsal midbrain syndrome, aka pretectal syndrome)

Pre-ga
~~Second~~

Post-ganglionic neurons
~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate (mainly) in the **pretectal nuclei**

Where are the pretectal nuclei located?

The dorsal midbrain

Pre-ga

~~Second~~

Damage to the pretectal

produces what eponymo

Parinaud syndrome (ak

~~pretectal syndrome~~)

What are the cardinal features of Parinaud syndrome?

--?

--?

--?

--?

Post-ganglionic neurons

~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate (mainly) in the **pretectal nuclei**

Where are the pretectal nuclei located?
The dorsal midbrain

Pre-ga
~~Second~~

Damage to the pretectal
produces what eponymo
Parinaud syndrome (ak
pretectal syndrome)

What are the cardinal features of Parinaud syndrome?
--Impaired upgaze
--Lid retraction
--Convergence-retraction nystagmus
--Light-near dissociation

Post-ganglionic neurons
~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate (mainly) in the **pretectal nuclei**

Where are the pretectal nuclei located?
The dorsal midbrain

Pre-ga
~~Second~~

Damage to the pretectal
produces what eponymo
Parinaud syndrome (ak
pretectal syndrome)

What are the cardinal features of Parinaud syndrome?
--Impaired upgaze
--Lid retraction
--Convergence-retraction nystagmus
--Light-near dissociation

Post-ganglionic neurons
~~Third-order neurons~~

What is light-near dissociation*?*

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate (mainly) in the **pretectal nuclei**

Where are the pretectal nuclei located?

The dorsal midbrain

Pre-ga

~~Second~~

Damage to the pretectal

produces what eponymo

Parinaud syndrome (ak

pretectal syndrome)

What are the cardinal features of Parinaud syndrome?

--Impaired upgaze

--Lid retraction

--Convergence-retraction nystagmus

--Light-near dissociation

Post-ganglionic neurons

~~Third-order neurons~~

What is light-near dissociation*?*

A phenomena in which pupils miose less robustly in response to light than they do as part of the near response

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the eponym-eponym nucleus

Post-ganglionic neurons

~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

Post-ganglionic neurons

~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the **Edinger-Westphal nucleus**

Where in relation to the CN3 nuclear complex is the Edinger-Westphal nucleus located?

Post-ganglionic neurons

~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the **Edinger-Westphal nucleus**

Where in relation to the CN3 nuclear complex is the Edinger-Westphal nucleus located?

It is a part of the complex

Post-ganglionic neurons

~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 into the important intracranial space

Post-ganglionic neurons

~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 into the cavernous sinus (CS)

Post-ganglionic neurons

~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ *'Top' inputs*

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with **CN3** into the cavernous sinus (CS)

As ocular-motor nerves go, is CN3 large, or small?

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ *'Top' inputs*

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with **CN3** into the cavernous sinus (CS)

As ocular-motor nerves go, is CN3 large, or small?

Quite large, with over # fibers (contrast that with the itty-bitty CN4 and its # fibers)

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ *'Top' inputs*

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with **CN3** into the cavernous sinus (CS)

As ocular-motor nerves go, is CN3 large, or small?
Quite large, with over 15,000 fibers (contrast that with the itty-bitty CN4 and its 2000 fibers)

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 into the cavernous sinus (CS)

--Exit CS with inferior v superior division of CN3

Post-ganglionic neurons

~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 into the cavernous sinus (CS)

--Exit CS with inferior division of CN3

Post-ganglionic neurons

~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 into the cavernous sinus (CS)

--Exit CS with inferior division of CN3

--Synapse in [redacted] ganglion

Post-ganglionic neurons

~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 into the cavernous sinus (CS)

--Exit CS with inferior division of CN3

--Synapse in ciliary ganglion

Post-ganglionic neurons

~~Third-order neurons~~

Horner Syndrome

***Parasympathetic* pathway:**

First-order neurons 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

Second-order neurons

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 into the cavernous sinus (CS)

--Exit CS with inferior division of CN3

--Synapse in **ciliary ganglion**

Where is the ciliary ganglion located?

Post-ganglionic neurons

Third-order neurons

Horner Syndrome

***Parasympathetic* pathway:**

First-order neurons 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

Second-order neurons

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 into the cavernous sinus (CS)

--Exit CS with inferior division of CN3

--Synapse in **ciliary ganglion**

Post-ganglionic neurons

Third-order neurons

Where is the ciliary ganglion located?
At the orbital apex

Horner Syndrome

Parasympathetic pathway:

~~First-order neurons~~ *'Top' inputs*

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 into the cavernous sinus (CS)

--Exit CS with

--**Synapse** in

Post-ganglionic

~~Third-order neurons~~

What neurotransmitter is found in this synapse?

Horner Syndrome

Parasympathetic pathway:

~~First-order neurons~~ *'Top' inputs*

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 into the cavernous sinus (CS)

--Exit CS with

--**Synapse** in

Post-ganglionic

~~Third-order neurons~~

What neurotransmitter is found in this synapse?
Acetylcholine (same as the pre←→post-ganglionic synapse of the sympathetic pathway)

Horner Syndrome

Parasympathetic pathway:

~~First-order neurons~~ *'Top' inputs*

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 into the cavernous sinus (CS)

--Exit CS with

--**Synapse** in

Post-ganglionic

~~Third-order neurons~~

What neurotransmitter is found in this synapse?

Acetylcholine (same as the pre←→post-ganglionic synapse of the sympathetic pathway)

The post-ganglionic ACh receptors of the sympathetic chain were of the still remember? *subtype.*

Horner Syndrome

Parasympathetic pathway:

~~First-order neurons~~ *'Top' inputs*

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 into the cavernous sinus (CS)

--Exit CS with

--**Synapse** in

Post-ganglionic

~~Third-order neurons~~

What neurotransmitter is found in this synapse?

Acetylcholine (same as the pre←→post-ganglionic synapse of the sympathetic pathway)

The post-ganglionic ACh receptors of the sympathetic chain were of the nicotinic subtype.

Horner Syndrome

Parasympathetic pathway:

~~First-order neurons~~ *'Top' inputs*

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 into the cavernous sinus (CS)

--Exit CS with

--**Synapse** in

Post-gangli

~~Third-order neurons~~

What neurotransmitter is found in this synapse?

Acetylcholine (same as the pre←→post-ganglionic synapse of the sympathetic pathway)

The post-ganglionic ACh receptors of the sympathetic chain were of the nicotinic subtype.
*How about the post-ganglionic **para**sympathetics—what type are they?*

Horner Syndrome

Parasympathetic pathway:

~~First-order neurons~~ *'Top' inputs*

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 into the cavernous sinus (CS)

--Exit CS with

--**Synapse** in

Post-ganglionic

~~Third-order neurons~~

What neurotransmitter is found in this synapse?

Acetylcholine (same as the pre←→post-ganglionic synapse of the sympathetic pathway)

The post-ganglionic ACh receptors of the sympathetic chain were of the nicotinic subtype.

*How about the post-ganglionic **para**sympathetics—what type are they?*

They too are nicotinic

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 until the cavernous sinus (CS)

--Exit CS with inferior division of CN3

--Synapse in ciliary ganglion

Post-ganglionic neurons

~~Third-order neurons~~

--Originate in ciliary ganglion

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 until the cavernous sinus (CS)

--Exit CS with inferior division of CN3

--Synapse in ciliary ganglion

Post-ganglionic neurons

~~Third-order neurons~~

--Originate in ciliary ganglion

--Travel with nerve to the [redacted] muscle

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 until the cavernous sinus (CS)

--Exit CS with inferior division of CN3

--Synapse in ciliary ganglion

Post-ganglionic neurons

~~Third-order neurons~~

--Originate in ciliary ganglion

--Travel with nerve to the inferior oblique muscle

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 until the cavernous sinus (CS)

--Exit CS with inferior division of CN3

--Synapse in ciliary ganglion

Post-ganglionic neurons

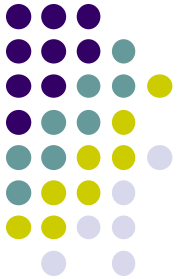
~~Third-order neurons~~

--Originate in ciliary ganglion

--Travel with nerve to the inferior oblique muscle

--At eye, jumps to two words nerves to reach the sphincter muscle

Horner Syndrome



***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 until the cavernous sinus (CS)

--Exit CS with inferior division of CN3

--Synapse in ciliary ganglion

Post-ganglionic neurons

~~Third-order neurons~~

--Originate in ciliary ganglion

--Travel with nerve to the inferior oblique muscle

--At eye, jumps to posterior ciliary nerves to reach the sphincter muscle

Horner Syndrome

Parasympathetic pathway:

First-order neurons 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

Second-order neurons

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 until the cavernous sinus (CS)

--Exit CS with inferior division of CN3

--**Synapse** in

Post-ganglionic neurons

Third-order neurons

--Originate in ciliary ganglion

--Travel with nerve to the inferior oblique muscle

--At eye, jumps to posterior ciliary nerves to reach the sphincter muscle

Recall that the NT at this synapse was abb.

Horner Syndrome

Parasympathetic pathway:

~~First-order neurons~~ *'Top' inputs*

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 until the cavernous sinus (CS)

--Exit CS with inferior division of CN3

--**Synapse** in

Post-ganglionic neurons

~~Third-order neurons~~

--Originate in ciliary ganglion

--Travel with nerve to the inferior oblique muscle

--At eye, jumps to posterior ciliary nerves to reach the sphincter muscle

Recall that the NT at this synapse was ACh

Horner Syndrome

Parasympathetic pathway:

~~First-order neurons~~ *'Top' inputs*

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 until the cavernous sinus (CS)

--Exit CS with inferior division of CN3

--**Synapse** in

Recall that the NT at this synapse was ACh, specifically of the remember? subtype

Post-ganglionic neurons

~~Third-order neurons~~

--Originate in ciliary ganglion

--Travel with nerve to the inferior oblique muscle

--At eye, jumps to posterior ciliary nerves to reach the sphincter muscle

Horner Syndrome

Parasympathetic pathway:

First-order neurons 'Top' inputs

--Originate mainly in the pretectal nuclei

Pre-ganglionic neurons

Second-order neurons

--Originate in the Edinger-Westphal nucleus

--Travels with CN3 until the cavernous sinus (CS)

--Exit CS with inferior division of CN3

--**Synapse** in

Post-ganglionic neurons

Third-order neurons

--Originate in ciliary ganglion

--Travel with nerve to the inferior oblique muscle

--At eye, jumps to posterior ciliary nerves to reach the sphincter muscle

Recall that the NT at this synapse was ACh, specifically of the nicotinic subtype

Horner Syndrome

Parasympathetic pathway:

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

What about the synapse between the 3rd order neuron and the effector organ—what's the NT there?

--Exit CS with inferior division of CN3

--**Synapse** in ciliary ganglion

Post-ganglionic neurons

~~Third-order neurons~~

--Originate in ciliary ganglion

--Travel with nerve to the inferior oblique muscle

--At eye, jumps to posterior ciliary nerve

Recall that the NT at this synapse was ACh, specifically of the nicotinic subtype

the sphincter muscle

Horner Syndrome

Parasympathetic pathway:

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

What about the synapse between the 3rd order neuron and the effector organ—what's the NT there?

It is also ACh

--Exit CS with inferior division of CN3

--**Synapse** in

Post-ganglionic neurons

~~Third-order neurons~~

--Originate in ciliary ganglion

--Travel with nerve to the inferior oblique muscle

--At eye, jumps to posterior ciliary nerves

Recall that the NT at this synapse was **ACh**, specifically of the nicotinic subtype

the sphincter muscle

Horner Syndrome

Parasympathetic pathway:

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

What about the synapse between the 3rd order neuron and the effector organ—what's the NT there?

It is also ACh

Is it also nicotinic?

--Exit CS with inferior division of CN3

--**Synapse** in

Post-ganglionic neurons

~~Third-order neurons~~

--Originate in ciliary ganglion

--Travel with nerve to the inferior oblique muscle

--At eye, jumps to posterior ciliary ner

Recall that the NT at this synapse was **ACh**, specifically *of the nicotinic subtype?*

the sphincter muscle

Horner Syndrome

Parasympathetic pathway:

~~First-order neurons~~ 'Top' inputs

--Originate mainly in the pretectal nuclei

What about the synapse between the 3rd order neuron and the effector organ—what's the NT there?

It is also ACh

Is it also nicotinic?

No, it is **muscarinic**

--Exit CS with inferior division of CN3

--**Synapse** in

Post-ganglionic neurons

~~Third-order neurons~~

--Originate in ciliary ganglion

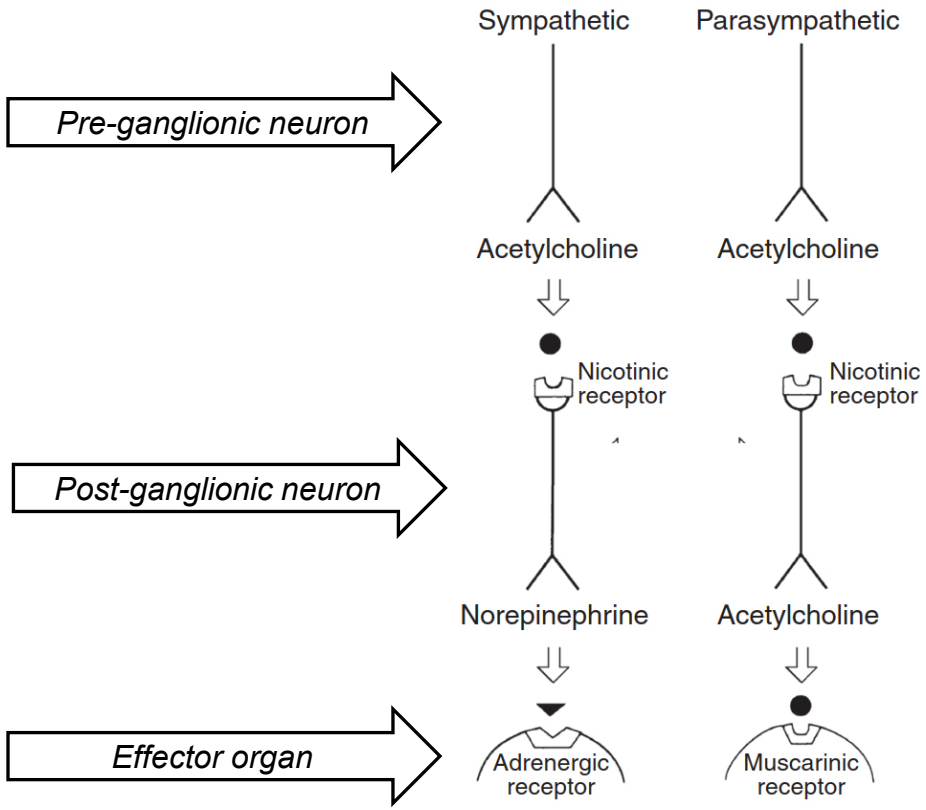
--Travel with nerve to the inferior oblique muscle

--At eye, jumps to posterior ciliary ner

Recall that the NT at this synapse was **ACh**, specifically *of the nicotinic subtype?* **No!**

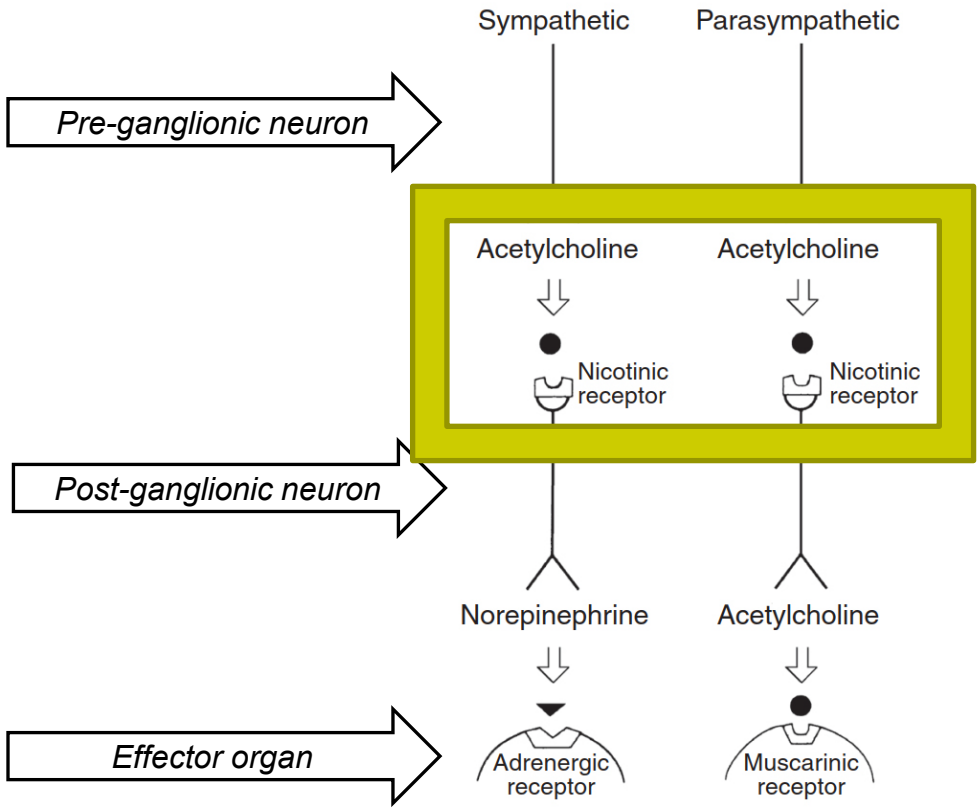
the sphincter muscle

Horner Syndrome



Summary of the neurotransmitters released and the types of receptors found within the ANS

Horner Syndrome

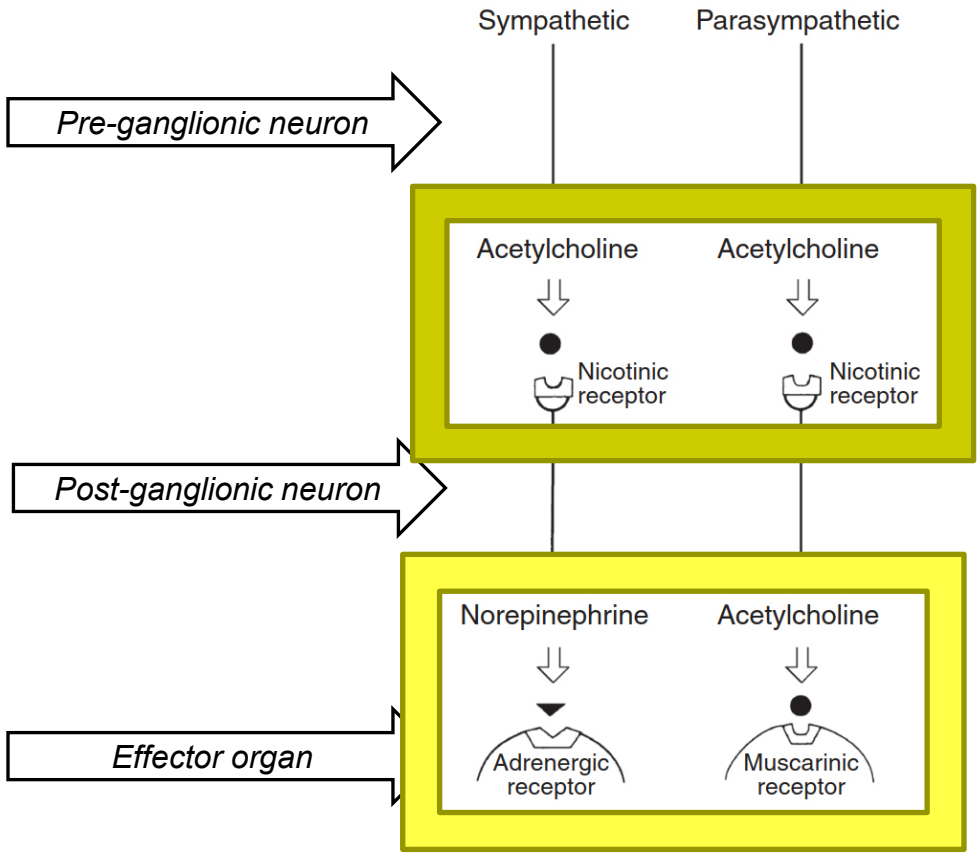


Key takeaways:

At the pre←→post-ganglionic synapse, both the sympathetic and parasympathetic systems have **nicotinic ACh receptors**

Summary of the neurotransmitters released and the types of receptors found within the ANS

Horner Syndrome



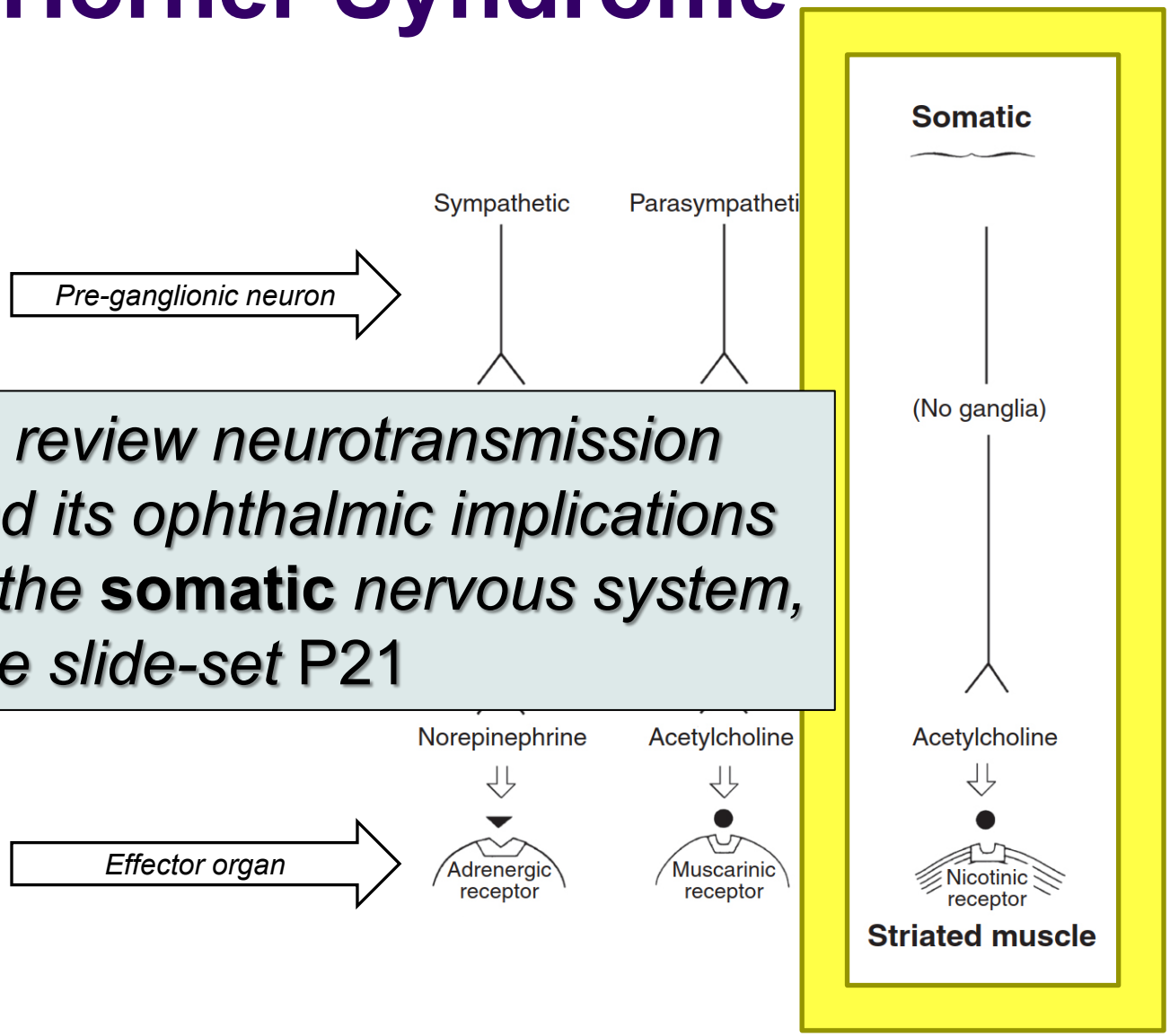
Key takeaways:

At the pre←→post-ganglionic synapse, both the sympathetic and parasympathetic systems have **nicotinic ACh receptors**

At the post-ganglionic←→effector synapse, the sympathetics have **noreppy**, whereas the parasympathetics have ***muscarinic* ACh receptors**

Summary of the neurotransmitters released and the types of receptors found within the ANS

Horner Syndrome



To review neurotransmission and its ophthalmic implications in the **somatic** *nervous system, see slide-set* P21

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' in
--Originate mainly in the preted

Finally, and in case you didn't notice, do: The relative lengths of the pre- and post-ganglionic parasympathetic neurons are opposite of what they were for the sympathetics.

Pre-ganglionic neurons

~~Second-order neurons~~
--Originate in the Edinger-West
--Travels with CN3 until the cav
--Exit CS with inferior division o
--Synapse in ciliary ganglion

Post-ganglionic neurons

~~Third-order neurons~~
--Originate in ciliary ganglion
--Travel with nerve to the inferior oblique muscle
--At eye, jumps to posterior ciliary nerves to reach the sphincter muscle

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' in
--Originate mainly in the preted

Finally, and in case you didn't notice, do: The relative lengths of the pre- and post-ganglionic parasympathetic neurons are opposite of what they were for the sympathetics. In the sympathetic pathway the pre-ganglionic fibers were short, extending from the Budge center to the CNS-adjacent stellate ganglion. The post-ganglionic sympathetic fibers run a long meandering course, using arteries as Ubers to take them through the head to their effector organs.

Pre-ganglionic neurons

~~Second-order neurons~~
--Originate in the Edinger-West
--Travels with CN3 until the cav
--Exit CS with inferior division o
--Synapse in ciliary ganglion

Post-ganglionic neurons

~~Third-order neurons~~
--Originate in ciliary ganglion
--Travel with nerve to the inferior oblique muscle
--At eye, jumps to posterior ciliary nerves to reach the sphincter muscle

Horner Syndrome

***Parasympathetic* pathway:**

~~First-order neurons~~ 'Top' in

--Originate mainly in the pretec

Pre-ganglionic neurons

~~Second-order neurons~~

--Originate in the Edinger-West

--Travels with CN3 until the cav

--Exit CS with inferior division o

--Synapse in ciliary ganglion

Post-ganglionic neurons

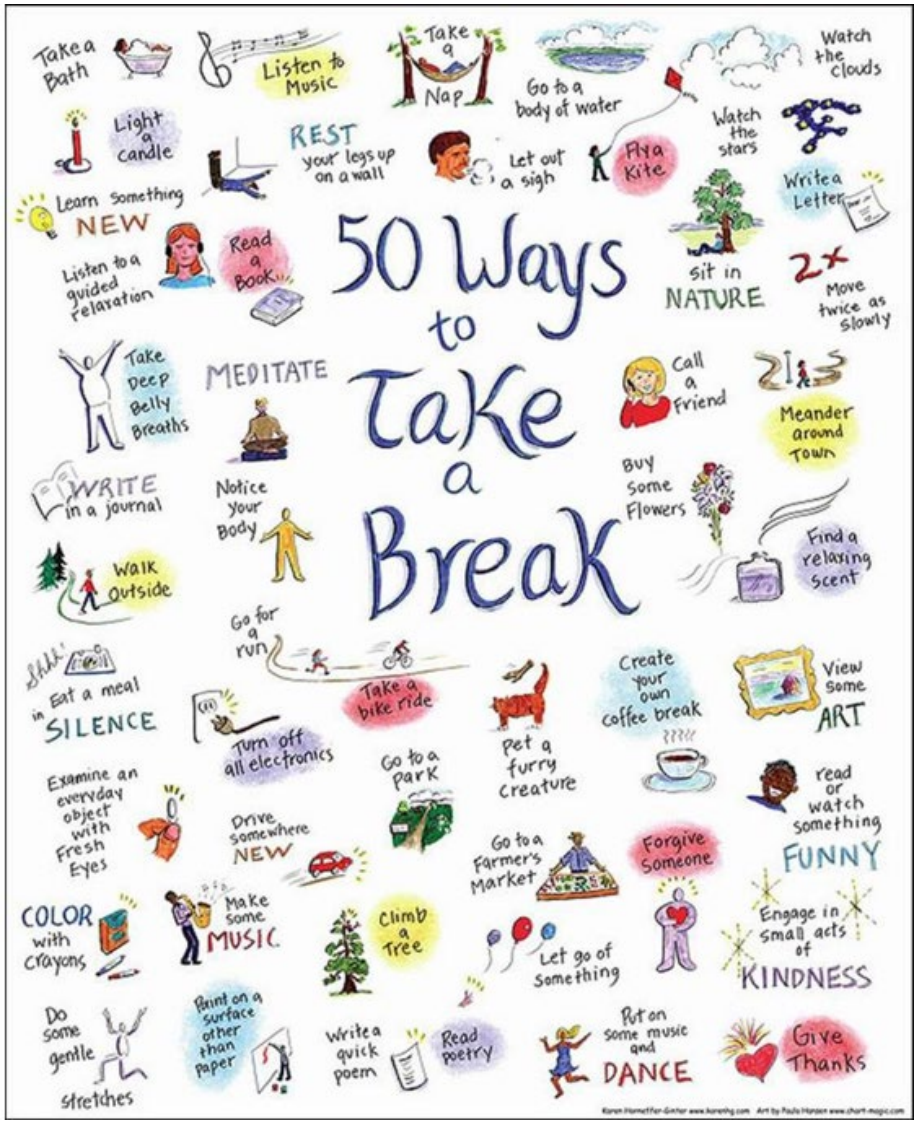
~~Third-order neurons~~

--Originate in ciliary ganglion

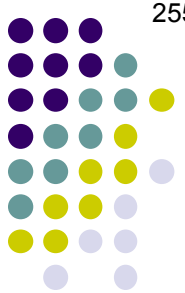
--Travel with nerve to the inferior oblique muscle

--At eye, jumps to posterior ciliary nerves to reach the sphincter muscle

Finally, and in case you didn't notice, do: The relative lengths of the pre- and post-ganglionic parasympathetic neurons are opposite of what they were for the sympathetics. In the sympathetic pathway the pre-ganglionic fibers were short, extending from the Budge center to the CNS-adjacent stellate ganglion. The post-ganglionic sympathetic fibers run a long meandering course, using arteries as Ubers to take them through the head to their effector organs. In contrast, the parasympathetic system puts its ganglia far from the CNS and near its effectors, thereby necessitating long pre-ganglionic fibers. From these effector-adjacent ganglia, it's a short hop for the post-ganglionics to reach their targets.

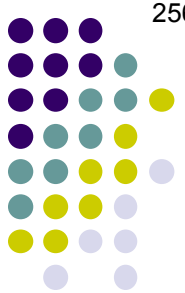


(This is a good point in the set to take a break)



Next we will review some important clinical features of Horner syndrome

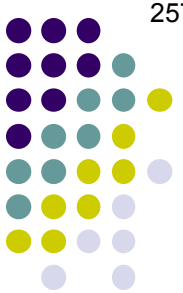
Q *For each condition, identify the type of Horner syndrome (**central**, **pre-ganglionic** or **post-ganglionic**) with which it is associated*



- Wallenberg syndrome:

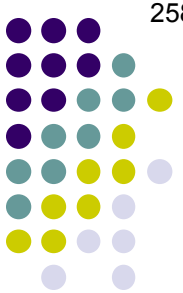
A

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



- Wallenberg syndrome: Central

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

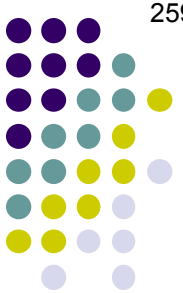


- Wallenberg syndrome: Central

What is the noneponymous name for Wallenberg syndrome?

A

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

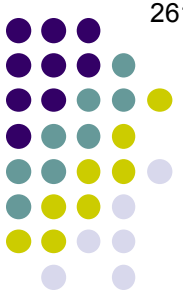


- Wallenberg syndrome: Central

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

Wallenberg (aka *lateral medullary*) syndrome

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

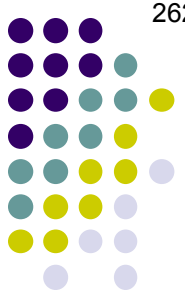


- Wallenberg syndrome: Central

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

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

A *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

Q *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?

Q/

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 [ipsi- vs contralateral] face and [ipsi- vs contralateral] body

Q/

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

Q *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?
--
--

A ***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; occasionally, intractable hiccups

Q ***For (central, p***

Speaking of intractable hiccups: Only two conditions discussed in the BCSC present with them. One is Wallenberg; what is the other?

- Wallenb

What is the none
Lateral medullary

Is the Horner pup
Ipsilateral

Wallenberg's hall
Loss of pain and

Besides the Horn
--Cerebellar signs
--Speech and swallowing difficulties; occasionally **intractable hiccups**

A

For
(central, p

- Wallenb

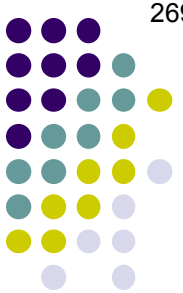
What is the none
Lateral medullary

Is the Horner pup
Ipsilateral

Wallenberg's hall
Loss of pain and

Besides the Horn
--Cerebellar signs
--Speech and swallowing difficulties; occasionally **intractable hiccups**

Speaking of intractable hiccups: Only two conditions discussed in the BCSC present with them. One is Wallenberg; what is the other?
Neuromyelitis optica spectrum disorder (NMOSD)



Q

For
(central, p

- Wallenb

Speaking of intractable hiccups: Only two conditions discussed in the BCSC present with them. One is Wallenberg; what is the other?
Neuromyelitis optica spectrum disorder (NMOSD)

In a nutshell, what is NMOSD?

What is the none
Lateral medullary

Is the Horner pup
Ipsilateral

Wallenberg's hall
Loss of pain and

Besides the Horn
--Cerebellar signs
--Speech and swallowing difficulties; occasionally **intractable hiccups**

A

For (central, p

- Wallenb

What is the none
Lateral medullary

Is the Horner pup
Ipsilateral

Wallenberg's hall
Loss of pain and

Besides the Horn
--Cerebellar signs
--Speech and swallowing difficulties; occasionally **intractable hiccups**

Speaking of intractable hiccups: Only two conditions discussed in the BCSC present with them. One is Wallenberg; what is the other?
Neuromyelitis optica spectrum disorder (NMOSD)

In a nutshell, what is NMOSD?
An immune-mediated inflammatory condition of the CNS involving the optic nerve, spinal cord, and various other CNS centers

Q For (central, p

- Wallenb

Speaking of intractable hiccups: Only two conditions discussed in the BCSC present with them. One is Wallenberg; what is the other?
Neuromyelitis optica spectrum disorder (NMOSD)

In a nutshell, what is NMOSD?
An immune-mediated inflammatory condition of the CNS involving the optic nerve, spinal cord, and various other CNS centers

What is the classic ocular manifestation in NMOSD?

What is the none
Lateral medullary

Is the Horner pup
Ipsilateral

Wallenberg's hall
Loss of pain and

Besides the Horn
--Cerebellar signs
--Speech and swallowing difficulties; occasionally **intractable hiccups**

A

For (central, p

- Wallenb

What is the nonep
Lateral medullary

Is the Horner pup
Ipsilateral

Wallenberg's hall
Loss of pain and

Besides the Horn
--Cerebellar signs
--Speech and swallowing difficulties; occasionally **intractable hiccups**

Speaking of intractable hiccups: Only two conditions discussed in the BCSC present with them. One is Wallenberg; what is the other?
Neuromyelitis optica spectrum disorder (NMOSD)

In a nutshell, what is NMOSD?
An immune-mediated inflammatory condition of the CNS involving the optic nerve, spinal cord, and various other CNS centers

What is the classic ocular manifestation in NMOSD?
Optic neuritis

Q

For
(central, p

- Wallenb

Speaking of intractable hiccups: Only two conditions discussed in the BCSC present with them. One is Wallenberg; what is the other?
Neuromyelitis optica spectrum disorder (NMOSD)

In a nutshell, what is NMOSD?
An immune-mediated inflammatory condition of the CNS involving the optic nerve, spinal cord, and various other CNS centers

What is the classic ocular manifestation in NMOSD?
Optic neuritis

What is the classic spinal cord manifestation?

What is the none
Lateral medullary

Is the Horner pup
Ipsilateral

Wallenberg's hall
Loss of pain and

Besides the Horn
--Cerebellar signs
--Speech and swallowing difficulties; occasionally **intractable hiccups**

A

For
(central, p

- Wallenb

Speaking of intractable hiccups: Only two conditions discussed in the BCSC present with them. One is Wallenberg; what is the other?
Neuromyelitis optica spectrum disorder (NMOSD)

In a nutshell, what is NMOSD?
An immune-mediated inflammatory condition of the CNS involving the optic nerve, spinal cord, and various other CNS centers

What is the classic ocular manifestation in NMOSD?
Optic neuritis

What is the classic spinal cord manifestation?
Transverse myelitis

What is the none
Lateral medullary

Is the Horner pup
Ipsilateral

Wallenberg's hall
Loss of pain and

Besides the Horn
--Cerebellar signs
--Speech and swallowing difficulties; occasionally **intractable hiccups**

Q For (central, p

- Wallenb

What is the nonep
Lateral medullary

Is the Horner pup
Ipsilateral

Wallenberg's hall
Loss of pain and

Besides the Horn
--Cerebellar signs
--Speech and swallowing difficulties; occasionally **intractable hiccups**

Speaking of intractable hiccups: Only two conditions discussed in the BCSC present with them. One is Wallenberg; what is the other?
Neuromyelitis optica spectrum disorder (NMOSD)

In a nutshell, what is NMOSD?
An immune-mediated inflammatory condition of the CNS involving the optic nerve, spinal cord, and various other CNS centers

What is the classic ocular manifestation in NMOSD?
Optic neuritis

What is the classic spinal cord manifestation?
Transverse myelitis

Intractable hiccups implies involvement of what CNS center?

A

For each condition, identify the type of Horner syndrome (central, p...

- Wallenb...

Speaking of intractable hiccups: Only two conditions discussed in the BCSC present with them. One is Wallenberg; what is the other?
Neuromyelitis optica spectrum disorder (NMOSD)

In a nutshell, what is NMOSD?
An immune-mediated inflammatory condition of the CNS involving the optic nerve, spinal cord, and various other CNS centers

What is the classic ocular manifestation in NMOSD?
Optic neuritis

What is the classic spinal cord manifestation?
Transverse myelitis

Intractable hiccups implies involvement of what CNS center?
The area postrema

What is the none...
Lateral medullary...

Is the Horner pup...
Ipsilateral

Wallenberg's hall...
Loss of pain and ...

Besides the Horn...
--Cerebellar signs...
--Speech and swallowing difficulties; occasionally, **intractable hiccups**

Q

For ... **(central, p** ...

- Wallenb...

What is the none...
Lateral medullary ...

Is the Horner pup...
Ipsilateral

Wallenberg's hall...
Loss of pain and ...

Besides the Horn...
--Cerebellar signs ...
--Speech and swallowing difficulties; occasionally, **intractable hiccups**

Speaking of intractable hiccups: Only two conditions discussed in the BCSC present with them. One is Wallenberg; what is the other?
Neuromyelitis optica spectrum disorder (NMOSD)

In a nutshell, what is NMOSD?
An immune-mediated inflammatory condition of the CNS involving the optic nerve, spinal cord, and various other CNS centers

What is the classic ocular manifestation in NMOSD?
Optic neuritis

What is the classic spinal cord manifestation?
Transverse myelitis

Intractable hiccups implies involvement of what CNS center?
The area postrema

What are the two other symptoms of area postrema syndrome?

A

For (central, p

- Wallenb

What is the nonep
Lateral medullary

Is the Horner pup
Ipsilateral

Wallenberg's hall
Loss of pain and

Besides the Horn
--Cerebellar signs
--Speech and swallowing difficulties; occasionally **intractable hiccups**

Speaking of intractable hiccups: Only two conditions discussed in the BCSC present with them. One is Wallenberg; what is the other?
Neuromyelitis optica spectrum disorder (NMOSD)

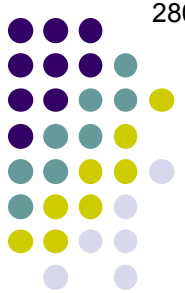
In a nutshell, what is NMOSD?
An immune-mediated inflammatory condition of the CNS involving the optic nerve, spinal cord, and various other CNS centers

What is the classic ocular manifestation in NMOSD?
Optic neuritis

What is the classic spinal cord manifestation?
Transverse myelitis

Intractable hiccups implies involvement of what CNS center?
The area postrema

What are the two other symptoms of area postrema syndrome?
Nausea and vomiting



For ... (central, p...

- Wallenb...

What is the nonep...
Lateral medullary

Is the Horner pup...

Loss of pain and ...

Besides the Horn...
--Cerebellar signs...
--Speech and swallowing difficulties; occasionally, **intractable hiccups**

Speaking of intractable hiccups: Only two conditions discussed in the BCSC present with them. One is Wallenberg; what is the other?
Neuromyelitis optica spectrum disorder (NMOSD)

In a nutshell, what is NMOSD?
An immune-mediated inflammatory condition of the CNS involving the optic nerve, spinal cord, and various other CNS centers

What is the classic ocular manifestation in NMOSD?
Optic neuritis

What is the classic spinal cord manifestation?
Transverse myelitis

For more on NMOSD, see slide-set N8

What are the two other symptoms of area postrema syndrome?
--Nausea and vomiting

Q ***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?

Disequilibrium

he lesion?

ontralateral body

ymptoms?

--Cerebellar signs: ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties; occasionally, intractable hiccups

A

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

he lesion?

ontralateral body

ymptoms?
--Cerebellar signs: **Disequilibrium** ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties; occasionally, intractable hiccups

Q ***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?

he lesion?

ntralateral body

ymptoms?

Disequilibrium

--Cerebellar signs: ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties; occasionally, intractable hiccups

A

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

Disequilibrium

Q

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 medull

Speaking of disequ
body is being 'pulle
Lateropulsion

In Wallenberg, do p
or away from it?
Toward it

Speaking of lateropulsion: Wallenberg pts often manifest something called **ocular lateropulsion**. *What are the findings in this condition?*
--

--
--

ymptoms?
--Cerebellar signs: **Disequilibrium**, ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties; occasionally, intractable hiccups

Q/A

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 medull

Speaking of disequ
body is being 'pulle
Lateropulsion

In Wallenberg, do p
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 slower v faster than are lateral movements toward the contralateral side
--
--

ymptoms?
--Cerebellar signs: **Disequilibrium**, ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties; occasionally, intractable hiccups

A

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 medull

Speaking of disequ
body is being 'pulle
Lateropulsion

In Wallenberg, do p
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
--
--

ymptoms?
--Cerebellar signs: **Disequilibrium**, ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties; occasionally, intractable hiccups

Q/A

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 medull

Speaking of disequ
body is being 'pulle
Lateropulsion

In Wallenberg, do p
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 v away from the lesion side
--

ymptoms?
--Cerebellar signs: **Disequilibrium**, ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties; occasionally, intractable hiccups

A

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 medull

Speaking of disequ
body is being 'pulle

Lateropulsion

In Wallenberg, do p
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
--

ymptoms?
--Cerebellar signs: **Disequilibrium**, ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties; occasionally, intractable hiccups

Q/A

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 medull

Speaking of disequ
body is being 'pulle
Lateropulsion

In Wallenberg, do p
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 (eg, during eye closure), the eyes will move into lateral gaze toward v away from the lesion side

ymptoms?
--Cerebellar signs: **Disequilibrium**, ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties; occasionally, intractable hiccups

A

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 medull

Speaking of disequ
body is being 'pulle

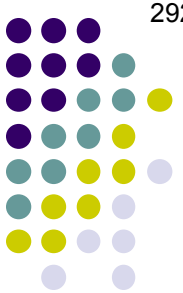
Lateropulsion

In Wallenberg, do p
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 (eg, during eye closure), the eyes will move into lateral gaze toward the lesion side

ymptoms?
--Cerebellar signs: **Disequilibrium**, ataxia, nystagmus, skew deviation
--Speech and swallowing difficulties; occasionally, intractable hiccups

Q *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

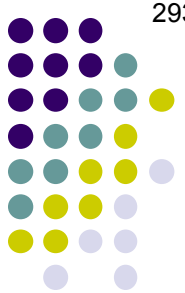
Wallenberg's hallmark symptom is sensory--wh
Loss of pain and temperature sensation t

Besides the Horner and sensory findings, what
--**Cerebellar signs**: Disequilibrium, ataxia, nyst
--**Speech and swallowing difficulties**; occasio

Occlusion of what vessel is implicated in Waller
The ipsilateral vertebral or (less commonly) pos

*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?*

A *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--wh
Loss of pain and temperature sensation t

Besides the Horner and sensory findings, what
--**Cerebellar signs**: Disequilibrium, ataxia, nyst
--**Speech and swallowing difficulties**; occasio

Occlusion of what vessel is implicated in Waller
The ipsilateral vertebral or (less commonly) pos

*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 or weakness

Q *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--wh
Loss of pain and temperature sensation t

Besides the Horner and sensory findings, what
--**Cerebellar signs**: Disequilibrium, ataxia, nyst
--**Speech and swallowing difficulties**; occasio

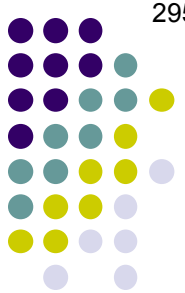
Occlusion of what vessel is implicated in Waller
The ipsilateral vertebral or (less commonly) pos

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 or weakness

Why no paralysis/weakness in Wallenberg's?

Q/

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--wh
Loss of pain and temperature sensation th

Besides the Horner and sensory findings, what
--**Cerebellar signs**: Disequilibrium, ataxia, nyst
--**Speech and swallowing difficulties**; occasio

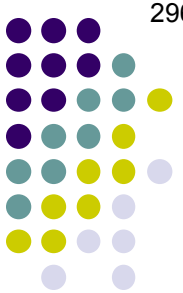
Occlusion of what vessel is implicated in Waller
The ipsilateral vertebral or (less commonly) pos

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 or weakness

Why no paralysis/weakness in Wallenberg's?
As in real estate, the three most important factors in CVA are [redacted].

A

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--wh
Loss of pain and temperature sensation t

Besides the Horner and sensory findings, what
--**Cerebellar signs**: Disequilibrium, ataxia, nyst
--**Speech and swallowing difficulties**; occasio

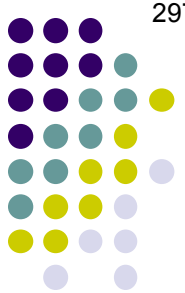
Occlusion of what vessel is implicated in Waller
The ipsilateral vertebral or (less commonly) pos

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 or weakness

Why no paralysis/weakness in Wallenberg's?
As in real estate, the three most important factors in CVA are location, location, and location .

A

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--wh
Loss of pain and temperature sensation t

Besides the Horner and sensory findings, what
--**Cerebellar signs**: Disequilibrium, ataxia, nyst
--**Speech and swallowing difficulties**; occasio

Occlusion of what vessel is implicated in Waller
The ipsilateral vertebral or (less commonly) pos

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 or weakness

Why no paralysis/weakness 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 (ie, "stroke without paralysis").

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--wh
Loss o

Besides the Horner and sensory findings, what
--**Cerebellar signs**: Disequilibrium, ataxia, n
--**Speech and swallowing** difficulties; occasion

Occlusion of what vessel is implicated in Waller
The ipsilateral vertebral or (less commonly) pos

Hence Wallenberg's noneponymous name

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?*
kness

Why no paralysis/weakness in Wallenberg's?
As in real estate, the three most important factors in VA are location, location, and location . And with re ect to CVA location, the general rule is, events that **affect the lateral brainstem** cause sensory loss, not paralysis (ie, "stroke without paralysis").

No question—proceed when ready

Q *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; occasionally, intractable hiccups

Occlusion of what vessel is implicated in Wallenberg syndrome?

A ***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; occasionally, intractable hiccups

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

Q ***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
--Cerebe
--Speec

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

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

A *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
--Cerebe
--Speec

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

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

Q ***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
--Cerebe
--Speec

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

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

A

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

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?

Besides
--Cereb
--Speec

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

Q ***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

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?

Besides
--Cerebe
--Speec

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

A ***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
--Cerebe
--Speec

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

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

Q ***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; occasionally, intractable hiccups

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

A ***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?
Good—most pts recover with minimal sequelae

?
Lateral medullary syndrome

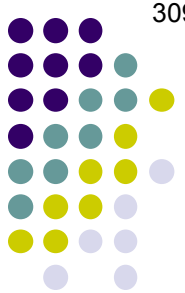
Is the Horner pupil in Wallenberg syndrome ipsi- or contralateral to the lesion?
Ipsilateral

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; occasionally, intractable hiccups

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

Q *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:

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

Q *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

If an adult with a pre- or post-ganglionic Horner's has no history of trauma, what process should be suspected?

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

If an adult with a pre- or post-ganglionic Horner's has no history of trauma, what process should be suspected?
An intrathoracic malignancy

Q

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:

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

Q

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

Where does Nb rank as a cause of cancer in childhood?

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

Q *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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

How about in infants (ie, prior to age 12 months)?

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

How about in infants (ie, prior to age 12 months)?
It is #1

Q *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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

How about in infants (ie, prior to age 12 months)?
It is #1

What proportion of peds cancer deaths are due to Nb?

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

How about in infants (ie, prior to age 12 months)?
It is #1

What proportion of peds cancer deaths are due to Nb?
20%

Q

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*

What proportion of peds cancer deaths are due to Nb?
20%

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the progenitor cell that gives rise to neuron and related cells

What proportion of peds cancer deaths are due to Nb?
20%

Q

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the progenitor cell that gives rise to **neuron** and **related cells**

What proportion of peds cancer deaths are due to Nb?
20%

?

?

Which 'neurons' and 'related cells' are involved in Nb, ie, where are the primaries?

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the progenitor cell that gives rise to **neuron** and **related cells**

What proportion of peds cancer deaths are due to Nb?
20%

Sympathetic chain neurons

Adrenal-medulla cells

Which 'neurons' and 'related cells' are involved in Nb, ie, where are the primaries?
The sympathetic chain, and the adrenal medulla

Q

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the progenitor cell that gives rise to **neuron** and **related cells**

What proportion of peds cancer deaths are due to Nb?
20%

Sympathetic chain neurons *?*

Adrenal-medulla cells *?*

Of the two sites, which can produce a Horner syndrome?

The sympathetic chain, and the adrenal medulla

Q/

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the progenitor cell that gives rise to **neuron** and **related cells**

What proportion of peds cancer deaths are due to Nb?
20%

Sympathetic chain neurons!

Adrenal-medulla cells

Of the two sites, which can produce a Horner syndrome?
The sympathetic chain (provided the tumor is in the [redacted] portion)

The sympathetic chain, and the adrenal medulla

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the progenitor cell that gives rise to **neuron** and **related cells**

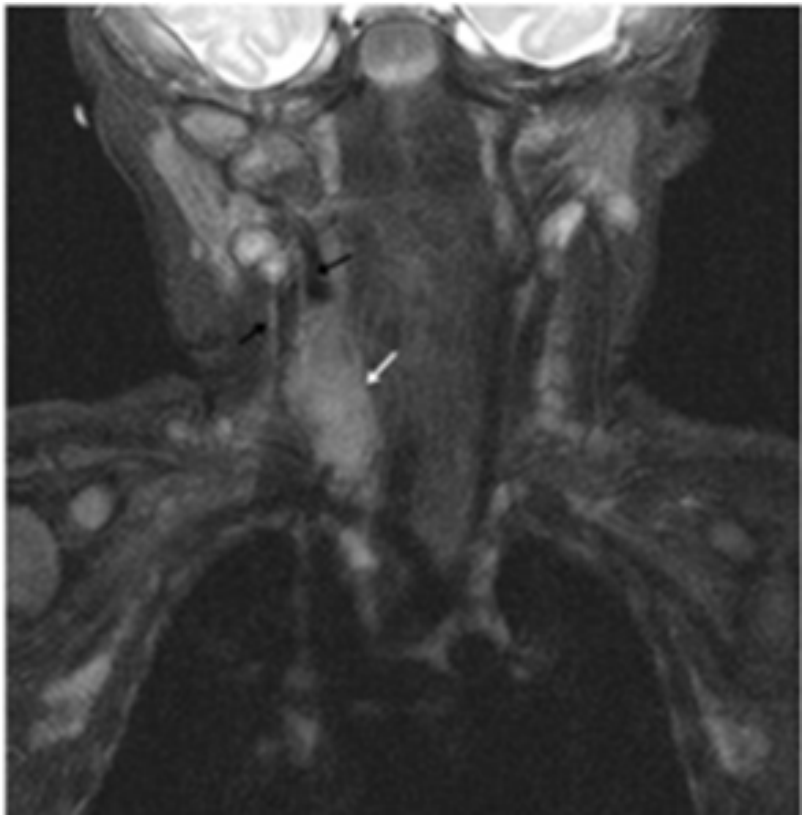
What proportion of peds cancer deaths are due to Nb?
20%

Sympathetic chain neurons*!*

Adrenal-medulla cells

Of the two sites, which can produce a Horner syndrome?
The sympathetic chain (provided the tumor is in the cervical portion)

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



Primary tumor in sympathetic chain

Horner syndrome 2ndry to Nb

Q

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the

Nb is notorious for three other ophthalmic manifestations—what are they?
--?
--?
--?

chain neurons

medulla cells

Of the two sites, which can produce a Horner syndrome?
The sympathetic chain (provided the tumor is in the cervical portion)

Q/

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the

Nb is notorious for three other ophthalmic manifestations—what are they?
--Periorbital ecchymosis (aka)
--*?*
--*?*

chain neurons

medulla cells

Of the two sites, which can produce a Horner syndrome?
The sympathetic chain (provided the tumor is in the cervical portion)

The sympathetic chain, and the adrenal medulla

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the

Nb is notorious for three other ophthalmic manifestations—what are they?
--Periorbital ecchymosis (aka *racoon eyes*)
--*?*
--*?*

chain neurons

medulla cells

Of the two sites, which can produce a Horner syndrome?
The sympathetic chain (provided the tumor is in the cervical portion)

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

Nb: ‘Raccoon eyes’

Q

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the

Nb is notorious for three other ophthalmic manifestations—what are they?
--Periorbital ecchymosis (aka *racoon eyes*)
--***?*** *[an orbit-related issue]*
--*?*

chain neurons

medulla cells

Of the two sites, which can produce a Horner syndrome?
The sympathetic chain (provided the tumor is in the cervical portion)

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the

Nb is notorious for three other ophthalmic manifestations—what are they?
--Periorbital ecchymosis (aka *racoon eyes*)
--Proptosis
--*?*

chain neurons

medulla cells

Of the two sites, which can produce a Horner syndrome?
The sympathetic chain (provided the tumor is in the cervical portion)

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

Nb: Proptosis

Q

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the

Nb is notorious for three other ophthalmic manifestations—what are they?
--Periorbital ecchymosis (aka *racoon eyes*)
--Proptosis
--***?*** *[an eye-movement issue]*

chain neurons

medulla cells

Of the two sites, which can produce a Horner syndrome?
The sympathetic chain (provided the tumor is in the cervical portion)

The sympathetic chain, and the adrenal medulla

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the

Nb is notorious for three other ophthalmic manifestations—what are they?
--Periorbital ecchymosis (aka *racoon eyes*)
--Proptosis
--Opsoclonus

chain neurons

medulla cells

Of the two sites, which can produce a Horner syndrome?
The sympathetic chain (provided the tumor is in the cervical portion)

Q

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the *Nb is notorious for three other ophthalmic manifestations—what are they?*

--**Periorbital ecchymosis**
--**Proptosis**
--Opsoclonus

What process leads to ecchymosis and/or proptosis?

chain neurons

medulla cells

Of the two sites, which can produce a Horner syndrome?
The sympathetic chain (provided the tumor is in the cervical portion)

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the

Nb is notorious for three other ophthalmic manifestations—what are they?
--**Periorbital ecchymosis**
--**Proptosis**
--Opsoclonus

What process leads to ecchymosis and/or proptosis?
Orbital metastasis

chain neurons

medulla cells

Of the two sites, which can produce a Horner syndrome?
The sympathetic chain (provided the tumor is in the cervical portion)

The sympathetic chain, and the adrenal medulla

Q

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the

Nb is notorious for three other ophthalmic manifestations—what are they?
--Periorbital ecchym
--Proptosis
--**Opsoclonus**

What is opsoclonus*?*

Of the two s
The sympathetic chain (provided the tumor is in the cervical portion)

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the

Nb is notorious for three other ophthalmic manifestations—what are they?
--Periorbital ecchym
--Proptosis
--**Opsoclonus**

What is opsoclonus*?*
A saccadic intrusion characterized by multivectorial, large-amplitude movements

Of the two s
The sympathetic chain (provided the tumor is in the cervical portion)

Q

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the

Nb is notorious for three other ophthalmic manifestations—what are they?
--Periorbital ecchym
--Proptosis
--**Opsoclonus**

What is opsoclonus*?*
A saccadic intrusion characterized by multivectorial, large-amplitude movements

Is opsoclonus secondary to orbital metastasis, like ecchymosis and proptosis?

Of the two s
The sympathetic chain (provided the tumor is in the cervical portion)

Q/

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the

Nb is notorious for three other ophthalmic manifestations—what are they?
--Periorbital ecchym
--Proptosis
--**Opsoclonus**

What is opsoclonus*?*
A saccadic intrusion characterized by multivectorial, large-amplitude movements

Is opsoclonus secondary to orbital metastasis, like ecchymosis and proptosis?
No—it is a [redacted] phenomenon

Of the two s
The sympathetic chain (provided the tumor is in the cervical portion)

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

Where does Nb rank as a cause of cancer in childhood?
It is the most common cause of extracranial solid cancer (ie, not leukemia) in childhood

The cancerous cell in NB—the neuroblast*—what is it?*
It is the

Nb is notorious for three other ophthalmic manifestations—what are they?
--Periorbital ecchym
--Proptosis
--**Opsoclonus**

What is opsoclonus*?*
A saccadic intrusion characterized by multivectorial, large-amplitude movements

Is opsoclonus secondary to orbital metastasis, like ecchymosis and proptosis?
No—it is a paraneoplastic phenomenon

Of the two s
The sympathetic chain (provided the tumor is in the cervical portion)

Q

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

What's the difference between a saccadic intrusion *and a* nystagmus*?*

--Proptosis

--**Opsoclonus**

saccadic intrusion characterized by multivectorial, large-amplitude movements

Is opsoclonus secondary to orbital metastasis, like ecchymosis and proptosis?
No—it is a paraneoplastic phenomenon

Of the two s
The sympathetic chain (provided the tumor is in the cervical portion)

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

What's the difference between a saccadic intrusion *and a* nystagmus*?*
It's all in how the event initiates. Both are characterized by involuntary eye movement that displaces fixation from its intended target; ie, the pt is trying to look at something, but their nystagmus/saccadic intrusion 'pushes' their eyes off of it.

--Proptosis
--**Opsoclonus**

saccadic intrusion characterized by multivectorial, large-amplitude movements

Is opsoclonus secondary to orbital metastasis, like ecchymosis and proptosis?
No—it is a paraneoplastic phenomenon

Of the two s
The sympathetic chain (provided the tumor is in the cervical portion)

Q

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

What's the difference between a saccadic intrusion *and a* nystagmus*?*
It's all in how the event initiates. Both are characterized by involuntary eye movement that displaces fixation from its intended target; ie, the pt is trying to look at something, but their nystagmus/saccadic intrusion 'pushes' their eyes off of it. It's in the nature of this initial push that nystagmus differs from saccadic intrusion. In nystagmus, the initial 'off fixation' movement is always slow v fast, whereas in a saccadic intrusion the initial movement is always slow v fast

--Proptosis
--**Opsoclonus**

saccadic intrusion characterized by multivectorial, large-amplitude movements

Is opsoclonus secondary to orbital metastasis, like ecchymosis and proptosis?
No—it is a paraneoplastic phenomenon

Of the two s
The sympathetic chain (provided the tumor is in the cervical portion)

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

What's the difference between a saccadic intrusion *and a* nystagmus*?*
It's all in how the event initiates. Both are characterized by involuntary eye movement that displaces fixation from its intended target; ie, the pt is trying to look at something, but their nystagmus/saccadic intrusion 'pushes' their eyes off of it. It's in the nature of this initial push that nystagmus differs from saccadic intrusion. In nystagmus, the initial 'off fixation' movement is always slow , whereas in a saccadic intrusion the initial movement is always fast

--Proptosis
--**Opsoclonus**

saccadic intrusion characterized by multivectorial, large-amplitude movements

Is opsoclonus secondary to orbital metastasis, like ecchymosis and proptosis?
No—it is a paraneoplastic phenomenon

Of the two s
The sympathetic chain (provided the tumor is in the cervical portion)

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

What's the difference between a saccadic intrusion *and a* nystagmus*?*
It's all in how the event initiates. Both are characterized by involuntary eye movement that displaces fixation from its intended target; ie, the pt is trying to look at something, but their nystagmus/saccadic intrusion 'pushes' their eyes off of it. It's in the nature of this initial push that nystagmus differs from saccadic intrusion. In nystagmus, the initial 'off fixation' movement is always slow , whereas in a saccadic intrusion the initial movement is always fast (ie, it's a saccade—hence the name).

--Proptosis
--**Opsoclonus**

saccadic intrusion characterized by multivectorial, large-amplitude movements

Is opsoclonus secondary to orbital metastasis, like ecchymosis and proptosis?
No—it is a paraneoplastic phenomenon

Of the two s
The sympathetic chain (provided the tumor is in the cervical portion)

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

What's the difference between a saccadic intrusion *and a* nystagmus*?*
It's all in how the event initiates. Both are characterized by involuntary eye movement that displaces fixation from its intended target; ie, the pt is trying to look at something, but their

For more on nystagmus and/or saccadic intrusions, see set P4

a saccade—hence the name).

--Proptosis
--**Opsoclonus**

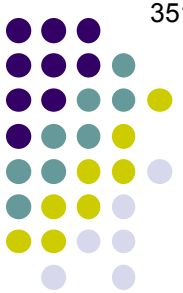
A **saccadic intrusion** characterized by multivectorial, large-amplitude movements

Is opsoclonus secondary to orbital metastasis, like ecchymosis and proptosis?
No—it is a paraneoplastic phenomenon

Of the two s
The sympathetic chain (provided the tumor is in the cervical portion)

Q

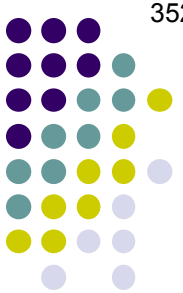
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated



- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection:

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
- Internal carotid dissection: Post-ganglionic

Q

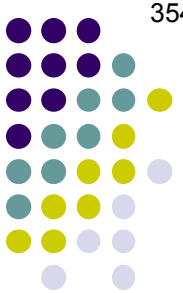
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- 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?

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
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner?
About 60

Q

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?

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
- 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

Q

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

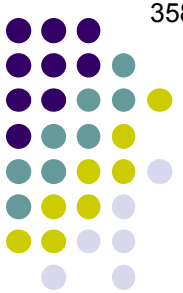
What percent of carotid-artery dissection pts will present with a Horner?
About 60

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?

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
- 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

Q

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:

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
- 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

Q

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

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—what are they?
--?
--?

pts will present with a Horner?

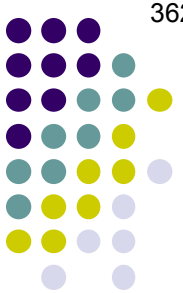
carotid-artery dissection?
's and Ehler-Danlos

ciated with trauma?

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

Q/

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

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—what are they?
--Ipsilateral periorbital
--*?*

pts will present with a Horner?

carotid-artery dissection?
's and Ehler-Danlos

ciated with trauma?

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

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
- Internal carotid dissection: Post-ganglionic

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—what are they?
--Ipsilateral periorbital pain
--***?***

pts will present with a Horner?

carotid-artery dissection?
's and Ehler-Danlos

ciated with trauma?

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

Q

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

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—what are they?
--Ipsilateral periorbital pain
--Ipsilateral two words

pts will present with a Horner?

carotid-artery dissection?
's and Ehler-Danlos

ciated with trauma?

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

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
- Internal carotid dissection: Post-ganglionic

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—what are they?
--Ipsilateral periorbital pain
--Ipsilateral vision disturbances

pts will present with a Horner?

carotid-artery dissection?
's and Ehler-Danlos

ciated with trauma?

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

Q

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

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—w
--**Ipsilateral periorbital pain**
--Ipsilateral vision disturbances

Can the pain radiate?

orner?

carotid-artery dissection?
's and Ehler-Danlos

ciated with trauma?

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

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
- Internal carotid dissection: Post-ganglionic

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—w
--**Ipsilateral periorbital pain**
--Ipsilateral vision disturbances

Can the pain radiate?
It can indeed, to the side or front of the head, and/or to the neck, and/or down the arm

orner?

carotid-artery dissection?
's and Ehler-Danlos

ciated with trauma?

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

Q

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

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—w
--Ipsilateral periorbital pain
--**Ipsilateral vision disturbances**

Can the pain radiate?

What is the classic visual complaint in this scenario?

carotid-artery dissection?
's and Ehler-Danlos

ciated with trauma?

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

Q/

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

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—w
--Ipsilateral periorbital pain
--**Ipsilateral vision disturbances**

Can the pain radiate?

What is the classic visual complaint in this scenario?
Recurrent episodes of [four words]

carotid-artery dissection?
's and Ehler-Danlos

ciated with trauma?

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

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
- Internal carotid dissection: Post-ganglionic

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—w
--Ipsilateral periorbital pain
--**Ipsilateral vision disturbances**

Can the pain radiate?

What is the classic visual complaint in this scenario?
Recurrent episodes of transient monocular vision loss

carotid-artery dissection?
's and Ehler-Danlos

ciated with trauma?

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

Q

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

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—what are they?
--Ipsilateral periorbital pain
--Ipsilateral vision disturbances

*What **un**likely complaints might a carotid-dissection Horner's pt have?*
--***?***
--***?***
--***?***
--***?***

pts will present with a Horner?

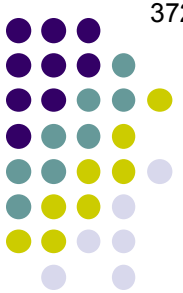
carotid-artery dissection?
's and Ehler-Danlos

ciated with trauma?

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

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
- Internal carotid dissection: Post-ganglionic

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—what are they?
--Ipsilateral periorbital pain
--Ipsilateral vision disturbances

*What **un**likely complaints might a carotid-dissection Horner's pt have?*
--Diplopia
--Dysgeusia
--Tongue paralysis
--Facial numbness

pts will present with a Horner?

carotid-artery dissection?
's and Ehler-Danlos

ciated with trauma?

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

Q

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

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—what are they?
--Ipsilateral periorbital pain
--Ipsilateral vision disturbances

*What **un**likely complaints might a carotid-dissection Horner's pt have?*
--Diplopia
--**Dysgeusia**
--Tongue paral
--Facial numbness

What is dysgeusia*?*

pts will present with a Horner?

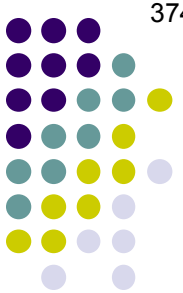
carotid-artery dissection?
's and Ehler-Danlos

ciated with trauma?

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

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
- Internal carotid dissection: Post-ganglionic

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—what are they?
--Ipsilateral periorbital pain
--Ipsilateral vision disturbances

*What **un**likely complaints might a carotid-dissection Horner's pt have?*
--Diplopia
--**Dysgeusia**
--Tongue paral
--Facial numbness

What is dysgeusia*?*
Altered taste perception

pts will present with a Horner?

carotid-artery dissection?
's and Ehler-Danlos

ciated with trauma?

Name a classic cause of 'iatrogenic' (I'm using the term loosely here) carotid-artery dissection:
Cervical-spine manipulation by a chiropractor

Q

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

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—what are they?
--Ipsilateral periorbital pain
--Ipsilateral vision disturbances

*What **un**likely complaints might a carotid-dissection Horner's pt have?*
--Diplopia
--Dysgeusia
--Tongue paralysis
--Facial numbness

How could a Horner syndrome possibly involve all this?

pts will present with a Horner?

carotid-artery dissection?
's and Ehler-Danlos

Nam
carotid-artery dissection.
Cervical-spine manipulation by a chiropractor

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
- Internal carotid dissection: Post-ganglionic

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—what are they?
--Ipsilateral periorbital pain
--Ipsilateral vision disturbances

*What **un**likely complaints might a carotid-dissection Horner's pt have?*
--Diplopia
--Dysgeusia
--Tongue paralysis
--Facial numbness

How could a Horner syndrome possibly involve all this?
Remember, the Horner's is just a manifestation of underlying pathology—in this case, carotid dissection

pts will present with a Horner?

carotid-artery dissection?
's and Ehler-Danlos

carotid-artery dissection.
Cervical-spine manipulation by a chiropractor

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
- Internal carotid dissection: Post-ganglionic

In addition to a Horner's, pts with carotid dissection will likely have two other complaints—what are they?
--Ipsilateral periorbital pain
--Ipsilateral vision disturbances

*What **un**likely complaints might a carotid-dissection Horner's pt have?*
--Diplopia
--Dysgeusia
--Tongue paralysis
--Facial numbness

How could a Horner syndrome possibly involve all this?
Remember, the Horner's is just a manifestation of underlying pathology—in this case, carotid dissection. If the dissection extends to the intracranial portion of the carotid, multiple cranial neuropathies may ensue, with the manifestations listed.

pts will present with a Horner?

carotid-artery dissection?
's and Ehler-Danlos

carotid-artery dissection.
Cervical-spine manipulation by a chiropractor

Q

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

If carotid dissection is suspected, what is the first step in management?

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
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner?
About 60

If carotid dissection is suspected, what is the first step in management?
Emergent neuroimaging

Q

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

If carotid dissection is suspected, what is the first step in management?
Emergent neuroimaging

What imaging study should be ordered?

A

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

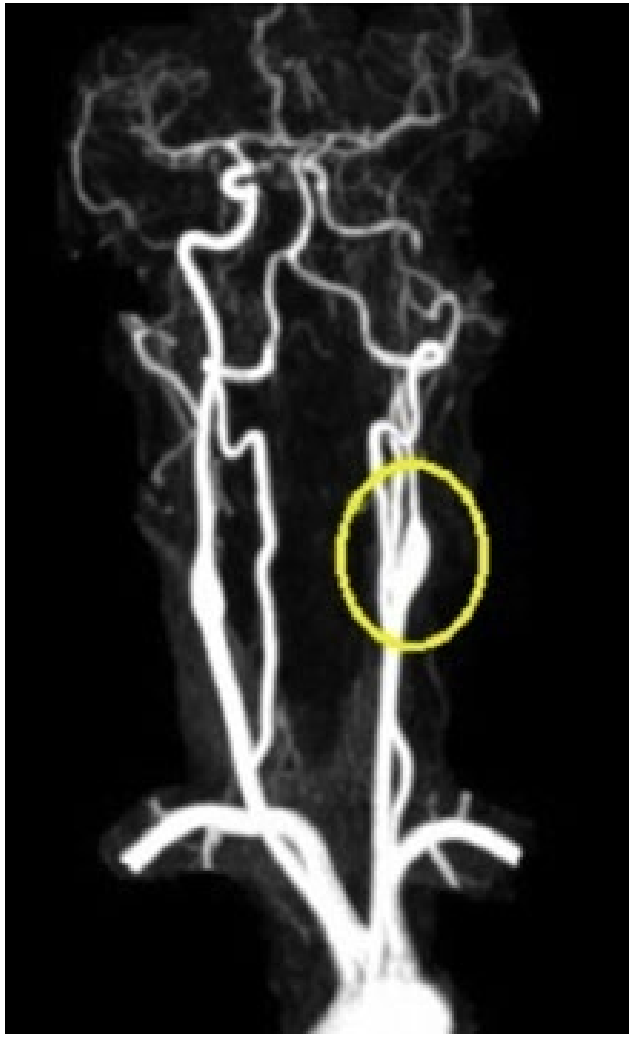
- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner?
About 60

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

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



Carotid dissection

Q

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

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?

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
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner?
About 60

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

Q

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

If carotid dissection is suspe
Emergent **neuroimaging**

What imaging study should b
Angiography—either CTA or

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?

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
- Internal carotid dissection: Post-ganglionic

What percent of carotid-artery dissection pts will present with a Horner?
About 60

If carotid dissection is suspe
Emergent **neuroimaging**

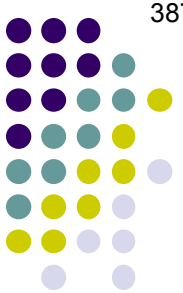
What imaging study should b
Angiography—either CTA or

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

Q

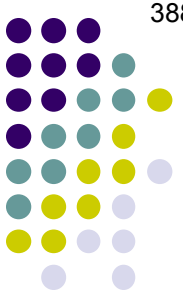
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated



- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor:

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
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic

Q

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*?*

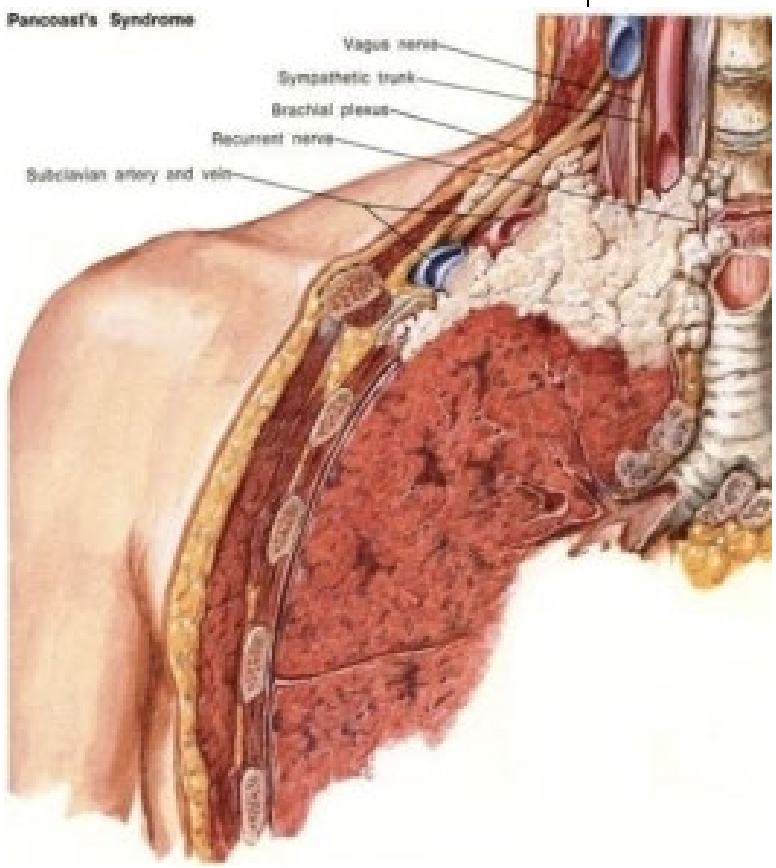
A

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

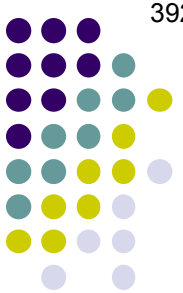
What is a Pancoast tumor*?*
A mass at or near the superior sulcus (=apex) of the lung

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



Pancoast tumor

Q *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:

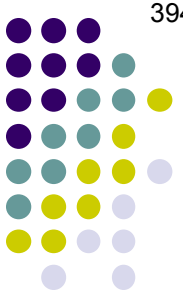
HA = 'Headache' (but we'll also use it to mean something else a few slides hence)

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
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic

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

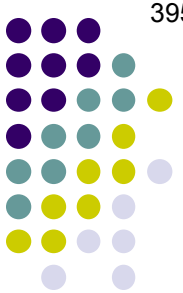


- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic

Is Horner syndrome a common finding in cluster HA?

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
- 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%

Q *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?

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
- 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! Remember, 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! Remember, 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!

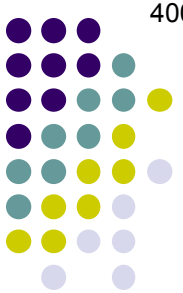
Q

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:

A

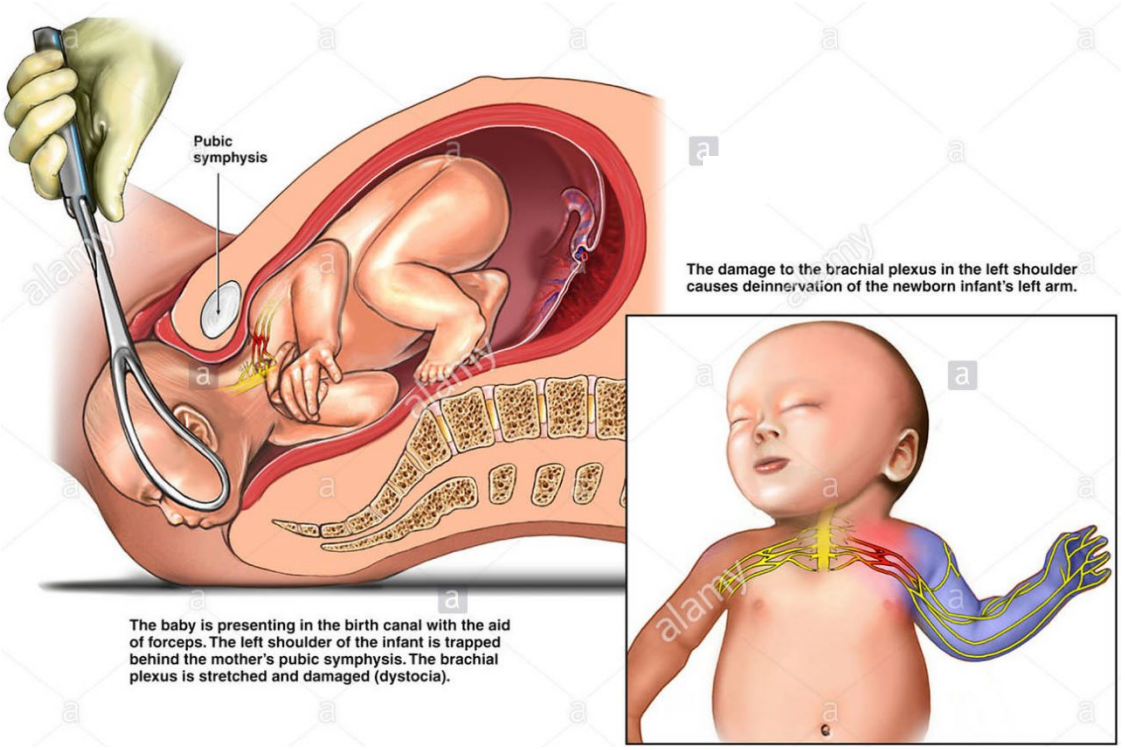
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

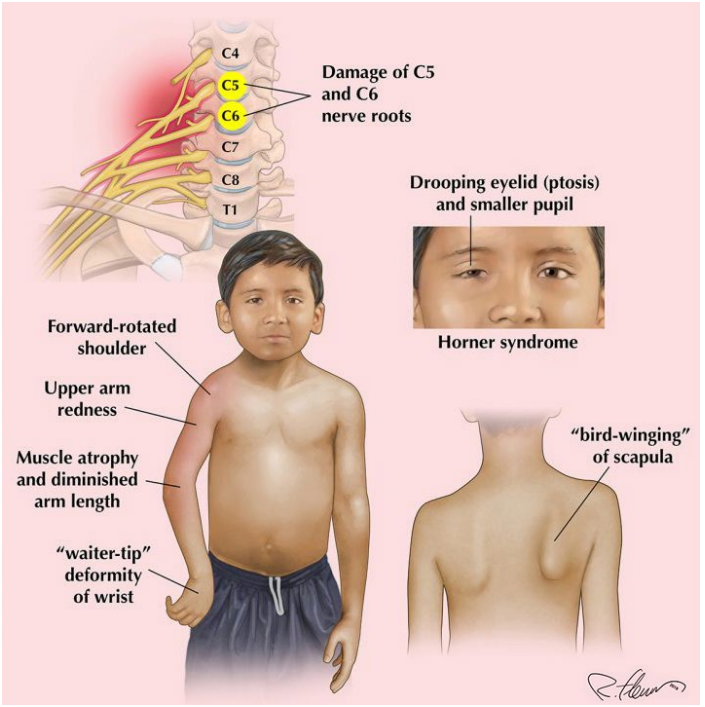


- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

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

Shoulder dystocia is another cause of congenital Horner's. Look for a hx of complicated birth, along with signs and symptoms of brachial-plexus injury/dysfunction.

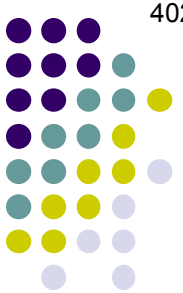




Forceps delivery/shoulder dystocia

Q

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

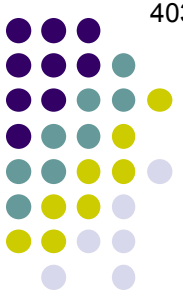


- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

How does one 'prove' a patient has a Horners?

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
- 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.

Q

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.**

Why is this? That is, what is it about cocaine drops that allows this assertion to be made?

Q/

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.**

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 [redacted] of norepinephrine.

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
- 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?
Cocaine's mechanism of action is to block the re-uptake of norepinephrine.

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
- 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?
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.

A

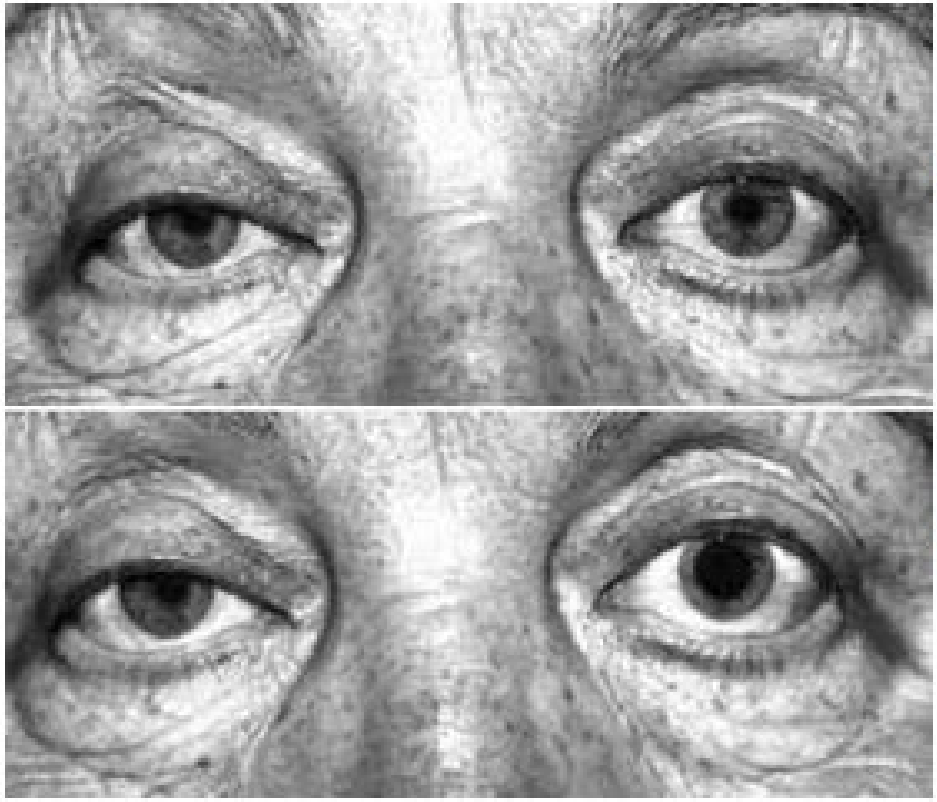
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic
- 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?
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 (ie, a failure to dilate) cocaine test.

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



Positive cocaine test (failure of anisocoria to resolve)

Q

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?

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
- 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.

Q *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?*

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.

Q/

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 [cause release? impede uptake?] norepinephrine into the neuromuscular junction.

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.**

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.

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.

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 intact. If

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.**

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 intact. 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.

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.

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 intact. 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

A. Before drops administered (suspected right Horner syndrome).

HA test

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

A. Before drops administered (suspected right Horner syndrome).
B. After drops administered. Note the dilation of both pupils. This indicates an intact 3rd-order, postganglionic neuron and localizes the lesion to the 1st-order or 2nd-order neuron.

HA test

Q

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 intact. 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?

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.

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 intact. 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.

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 intact. 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).**

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
- 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

What is the brand name for HA drops?

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.

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
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

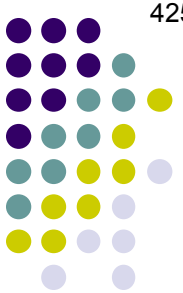
How does one 'prove' a patient has a Horners?
Cocaine drop testing. Cocaine will essentially eliminate anisocoria *if and only if* the sympathetic chain

What is the brand name for HA drops?
Paredrine

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.

Q

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?

- **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.

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

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.

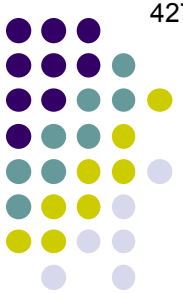
- **Forceps delivery: Pre- or post-ganglionic**

How does one 'prove' a patient has a 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.

Q

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



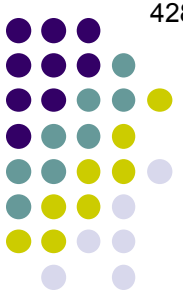
- Wallenberg syndrome: Central
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: Pre-ganglionic

*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?

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

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.

Q

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

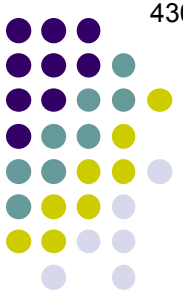
Why will ***HA drop testing be non-localizing if the Horner syndrome is secondary to a history of neck trauma from forceps delivery****?*

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?

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

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

Q

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?

Q/

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****?*

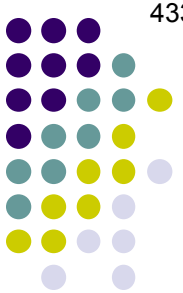
What implications does this hold for managing Horner syndrome in children?
It implies one cannot rely on HA testing to differentiate between pre- and post-ganglionic Horner's in children. Because of this, drop testing cannot be relied upon to rule out neuroblastoma.

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 [redacted] testing should be undertaken.

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

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.

Q

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.

What does VMA *stand for in this context? Hint: It's not 'Video Music Awards.' (Good one Dr Flynn!)*

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

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.

What does VMA *stand for in this context? Hint: It's not 'Video Music Awards.' (Good one Dr Flynn!)*
Vanillylmandelic acid (VMA) is a catecholamine metabolite. Its measurement in urine is used for screening children for catecholamine-secreting tumors such as neuroblastoma.

Q

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****?*

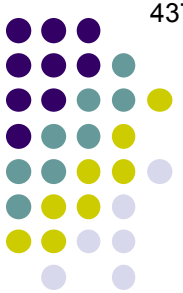
What implications does this hold for managing Horner syndrome in children?
It implies one cannot rely on HA testing to differentiate between pre- and post-ganglionic Horner's in children. Because of this, drop testing cannot be relied upon to rule out neuroblastoma.

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 [redacted] as well.

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

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.

Q

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.

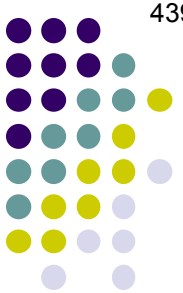
Which is more likely to be associated with neuroblastoma: A congenital Horner's, or one acquired in infancy or early childhood?
Acquired Horner's

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?*

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

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.

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

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.

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

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.

Q

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?

- 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.

A

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

α

- *In actuality, cocaine and HA drop testing are rarely performed—why?*
  These drugs are highly controlled substances—difficult to acquire and maintain
- 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.

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

- 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?

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.

A

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

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- 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

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.

Q

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

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- 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 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.

A

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

- 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 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.

Q

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?

- 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.

Q/

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

- 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 selective [redacted] agonist

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.

A

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 α-adrenergic agonist
- 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.

Q

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

- 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 selective α-adrenergic agonist

Which alpha receptors are involved in pupil dilation?

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.

A

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 α-adrenergic agonist
- *Which alpha receptors are involved in pupil dilation?*
  α_1

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.

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

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- 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?

Which alpha receptors are involved in pupil dilation?
α_1

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.

A

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 Horners is confirmed.

Which alpha receptors are involved in pupil dilation?
α_1

- 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.

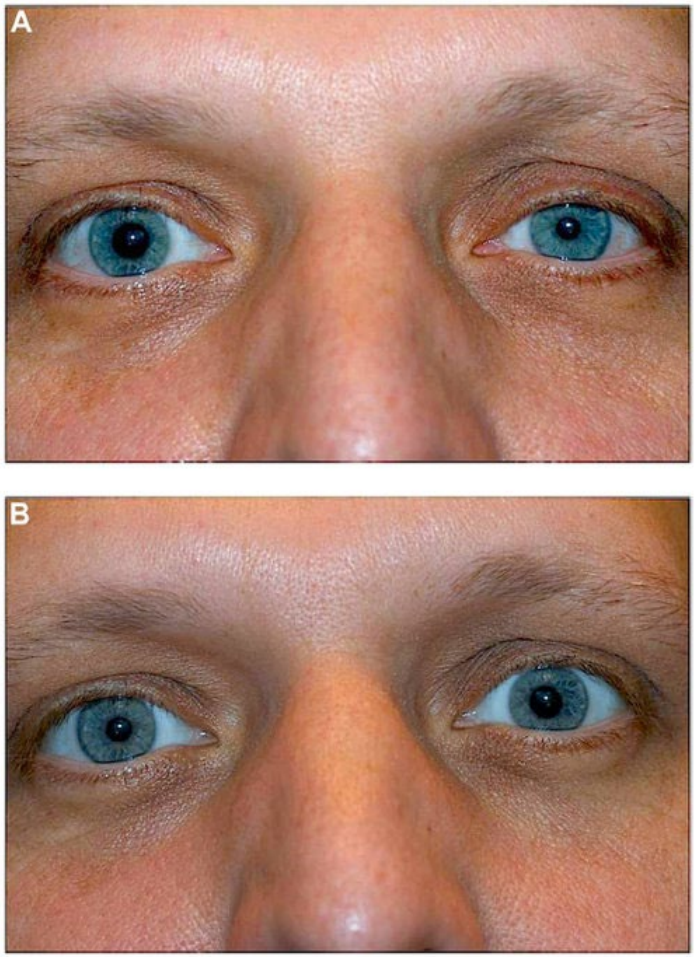
How does one differentiate between a pre- and post-ganglionic Horners?
Hydroxyamphetamine (HA) drop testing. HA drops will eliminate anisocoria **if** the post-ganglionic neuron is intact; therefore, pupillary dilation indicates a pre-ganglionic/central Horners.

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

A. Before drops administered (suspected left Horner syndrome).

Apraclonidine testing

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



A. Before drops administered (suspected left Horner syndrome).
B. After drops administered. Note the slight "reversal of anisocoria" in the left eye

Apraclonidine testing

Q

*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 Horners is confirmed.**

α_1

- Forceps delivery: Pre- or post-ganglionic

What is the physiological basis of anisocoria reversal in response to apraclonidine in Horner syndrome?

A

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 Horners is confirmed.**
- *Which alpha receptors are involved in pupil dilation?*
  α_1
- Forceps delivery: Pre- or post-ganglionic

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.

Q

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 Horners is confirmed.**

Which alpha receptors are involved in pupil dilation?
α_1

- Forceps delivery: Pre- or post-ganglionic

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

How long after the Horner-inciting injury to the sympathetic pathway does it take for denervation supersensitivity to develop?

A

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

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- 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 Horners is confirmed.**

Which alpha receptors are involved in pupil dilation?
α_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

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)

Q

*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 Horners is confirmed.

α_1

- Forceps delivery: Pre- or post-ganglionic

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?

A

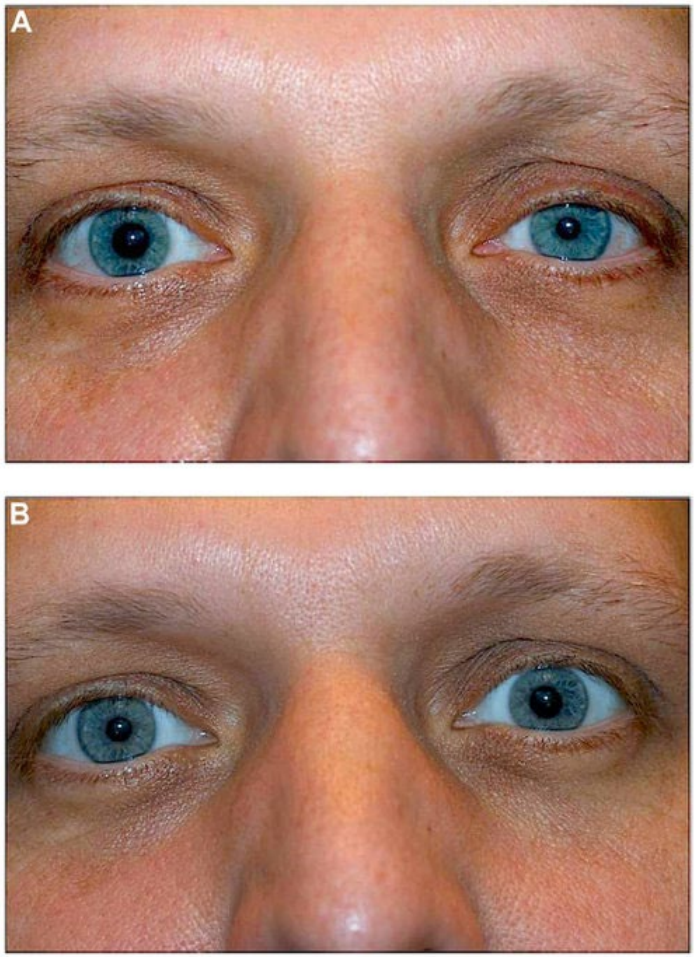
For each condition, identify the type of Horner syndrome (central, pre-ganglionic or post-ganglionic) with which it is associated

- *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 Horners is confirmed.
- *Which alpha receptors are involved in pupil dilation?*
  α_1
- Forceps delivery: Pre- or post-ganglionic

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

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



A. Before drops administered (suspected left Horner syndrome). **B.** After drops administered. Note the slight "reversal of anisocoria" in the left eye ***and the resolution of ptosis.***

Apraclonidine testing

Q

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 Horners is confirmed.

Which alpha receptors are involved in pupil dilation?
α_1

- Forceps delivery: Pre- or post-ganglionic

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?

A

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 Horners is confirmed.

α_1

- Forceps delivery: Pre- or post-ganglionic

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

Q

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 Horners is confirmed.

How is apraclonidine used to differentiate between a pre- and post-ganglionic Horners?

Which alpha receptors are involved in pupil dilation?
α_1

- Forceps delivery: Pre- or post-ganglionic

A

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 Horners is confirmed.

- *How is apraclonidine used to differentiate between a pre- and post-ganglionic Horners?*
  It can't

- *Which alpha receptors are involved in pupil dilation?*
  α_1

- Forceps delivery: Pre- or post-ganglionic

Q

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?

A

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

Q

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

  Why not? Aren't they very similar meds?

A

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

- *Why not? Aren't they very similar meds?*
  For purposes of Horner drop-testing, not similar enough. While apraclonidine preferentially stimulates the α_2 receptor, it still provides some stimulation of the α_1 receptors of the dilator muscles.

A

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

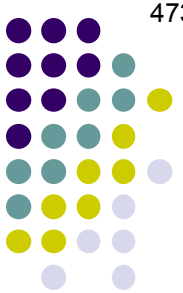
- *What drop test can be performed in their stead?*
  Apraclonidine (Iopidine) testing

- *I'm out of apraclonidine. Can I use brimonidine instead?*
  I'm afraid not

- *Why not? Aren't they very similar meds?*
  For purposes of Horner drop-testing, not similar enough. While apraclonidine preferentially stimulates the α_2 receptor, it still provides some stimulation of the α_1 receptors of the dilator muscles. In contrast, bromonidine is a **highly**-selective α_2 agonist, and as such provides little to no α_1 stimulation, and therefore will **not** induce pupil dilation.

Q

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

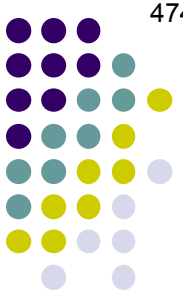


- Wallenberg syndrome: **Central**
- Neck trauma: Pre- or post-ganglionic
- Neuroblastoma: **Pre-ganglionic**
- Internal carotid dissection: Post-ganglionic
- Pancoast tumor: Pre-ganglionic
- Cluster HA: Post-ganglionic
- Forceps delivery: Pre- or post-ganglionic

Which drop test differentiates between a pre-ganglionic and central Horners?

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**
- 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 Horners?
None. A central Horners is usually apparent by the company it keeps, or by history.

Q

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 Horners?
None. A central Horners is usually apparent by **the company it keeps**, or by history.

What sorts of findings would be associated with a central Horners?

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**
- 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 Horners?
None. A central Horners is usually apparent by **the company it keeps**, or by history.

What sorts of findings would be associated with a central Horners?
Significant neurological impairment including difficulties with speaking, swallowing and/or balance, as well as disordered movements (ie, a Wallenberg-type scenario)

Q *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 Horners?
None. A central Horners is usually apparent by the company it keeps, or by **history**.

What history would be associated with a central Horners?

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**
- 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 Horners?
None. A central Horners is usually apparent by the company it keeps, or by **history**.

What history would be associated with a central Horners?
Associated history could include significant intracranial events (CVA, tumor, meningitis, a bleed) or a history of significant high C-spine trauma (fracture, dislocation).

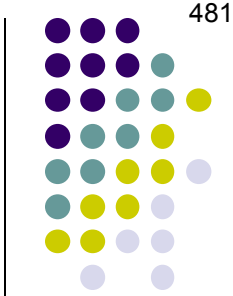
Q

- Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:
  - uppermost level needing imaging
  -
  -

A

- Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:
  - Head
  -
  -

Q

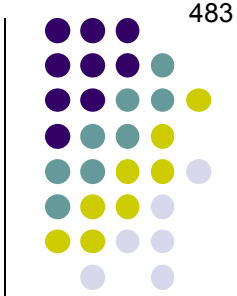


- Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:
  - Head
  -
  -
- …with attention to the:
  - specific aspect of head
  -
  -
  -

A

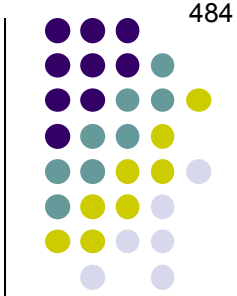
- Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:
  - Head
  -
  -
- …with attention to the:
  - Skull base
  -
  -
  -

Q



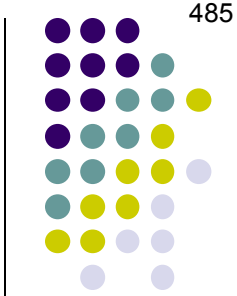
- Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:
  - Head
  - next level needing imaging
  -
- …with attention to the:
  - Skull base
  -
  -
  -

A



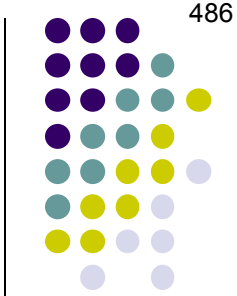
- Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:
  - Head
  - Neck
  -
- …with attention to the:
  - Skull base
  -
  -
  -

Q



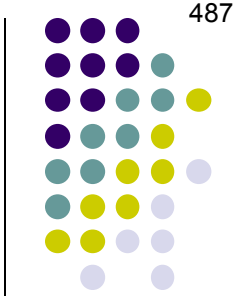
- Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:
  - Head
  - Neck
  -
- …with attention to the:
  - Skull base
  - specific structure in neck
  -
  -

A



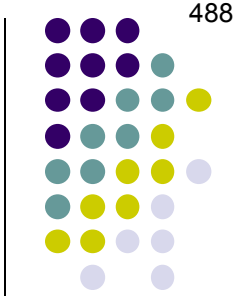
- Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:
  - Head
  - Neck
  -
- …with attention to the:
  - Skull base
  - Internal carotid artery
  -
  -

Q



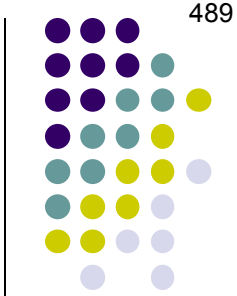
- Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:
  - Head
  - Neck
  - next level needing imaging
- …with attention to the:
  - Skull base
  - Internal carotid artery
  -
  -

A



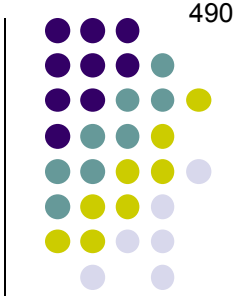
- Unless congenital, and absent a definite trauma history, a Horner syndrome must be worked up with imaging of the:
  - Head
  - Neck
  - Upper chest
- …with attention to the:
  - Skull base
  - Internal carotid artery
  -
  -

Q



- 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

A



- 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