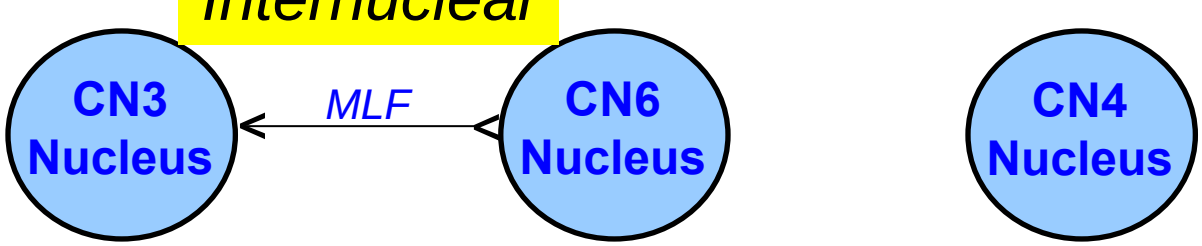
Motility Disorders: *The Sinus, the Fissure, and the Apex*

Supranuclear

Internuclear

Nuclear



Infranuclear

- Fascicular
- Subarachnoid
- Cavernous sinus
- Orbital
- Neuromuscular junction
- Extraocular muscle

This slide captures one way to think about the motility disorders. If it is unfamiliar, I strongly suggest you review the slide-set entitled ***'Motility disorders: Overview'*** before proceeding.

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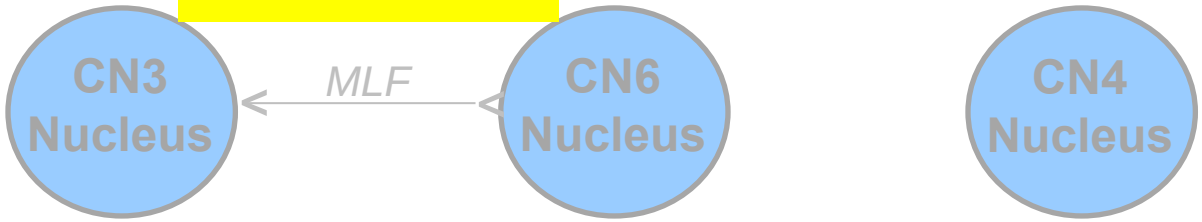

Infranuclear

- Fascicular
- Subarachnoid
- **Cavernous sinus**
- *Superior orbital fissure*
- **Orbital** *apex*

In this slide-set, we'll take a look at motility disorders stemming from pathology of the *cavernous sinus (CS)*, *superior orbital fissure (SOF)* and the *orbital apex (OA)*

Motility Disorders: *The Sinus, the Fissure, and the Apex*

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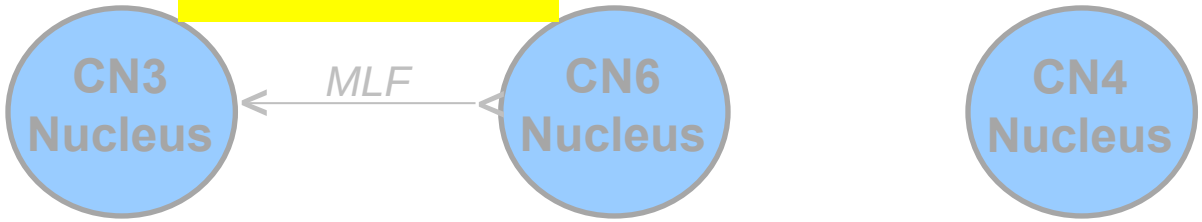

Infranuclear

- Fascicular
- Subarachnoid
- **Cavernous sinus**
  - *Superior orbital fissure*
  - **Orbital** *apex*
- Neuromuscular junctio
- Extraocular muscle

What is the hallmark of pathology involving these three locations?

Motility Disorders: *The Sinus, the Fissure, and the Apex*

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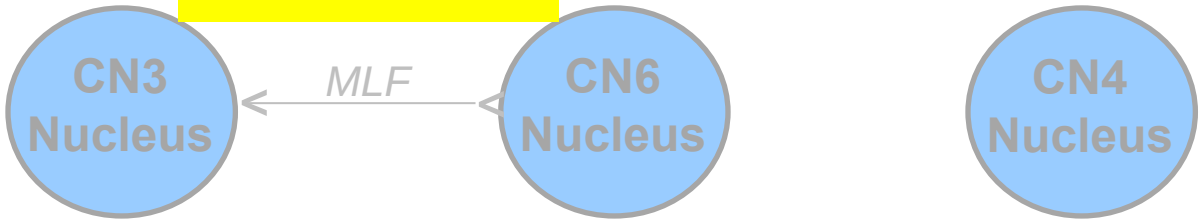

Infranuclear

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What is the hallmark of pathology involving these three locations?
Deficits implicating multiple nerves simultaneously

Motility Disorders: *The Sinus, the Fissure, and the Apex*

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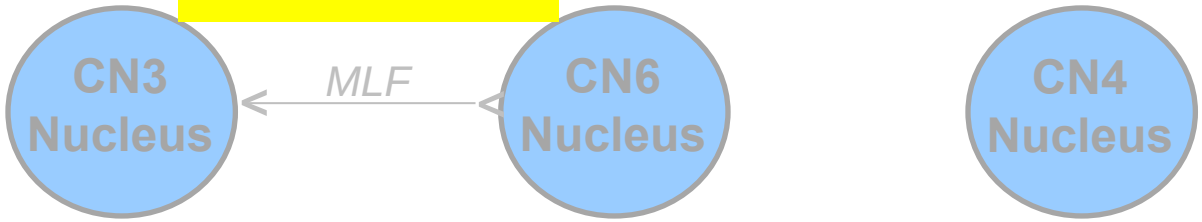

Infranuclear

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What is the hallmark of pathology involving these three locations?
Deficits implicating multiple nerves simultaneously

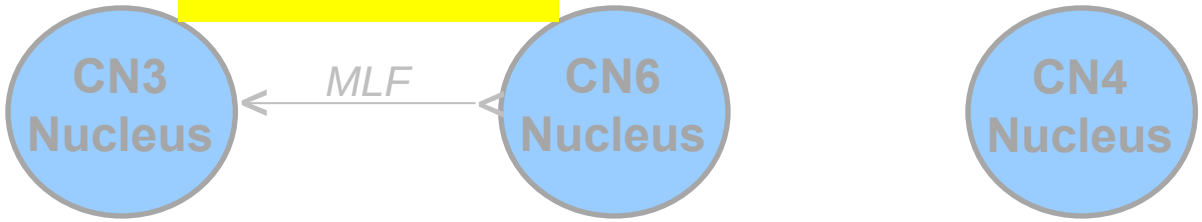
Which nerves can be involved?
--?
--?
--?
--?
--?
--?

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Supranuclear

Internuclear

Nuclear



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- Fascicular
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- **Cavernous sinus**
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- Extraocular muscle

What is the hallmark of pathology involving these three locations?
Deficits implicating multiple nerves simultaneously

Which nerves can be involved?
--Optic nerve
--CN3
--CN4
--CNV (specifically V1 and V2)
--CN6
--Postganglionic sympathetics

Motility Disorders: *The Sinus, the Fissure, and the Apex*

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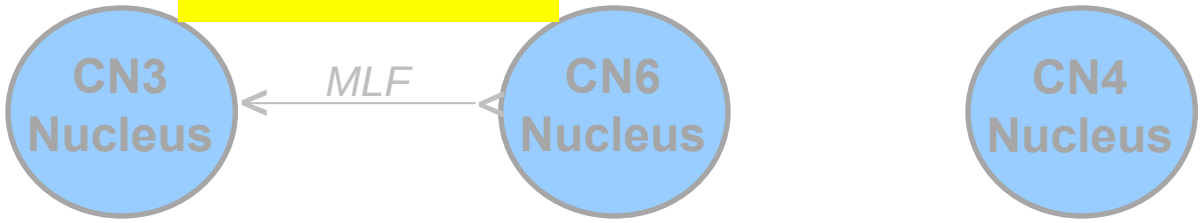

Infranuclear

- Fascicular
- Subarachnoid
- **Cavernous sinus**
  - Superior orbital fissure
  - **Orbital** apex
- Neuromuscular junctio
- Extraocular muscle

What is the hallmark of pathology involving these three locations?

Note: Some sources contend that the mandibular nerve (V3) can be affected by pathology in the posteriormost portion of the sinus. However, the most recent (at the time this slide-set was last edited) version of the BCSC *Neuro* book makes no mention of this.

--CN4

--CNV (specifically V1 and V2) *including V3?*

--CN6

--Postganglionic sympathetics

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Anatomically speaking, how are the cavernous sinus, superior orbital fissure and orbital apex related to one another?

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ◄——————————————————————► *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

Anatomically speaking, how are the cavernous sinus, superior orbital fissure and orbital apex related to one another?

They are 'ducks in a row' in that the orbital apex is in direct communication with the cavernous sinus via the superior orbital fissure

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ◄——————————————————————► *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?

Two

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?
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Where are they located?

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?
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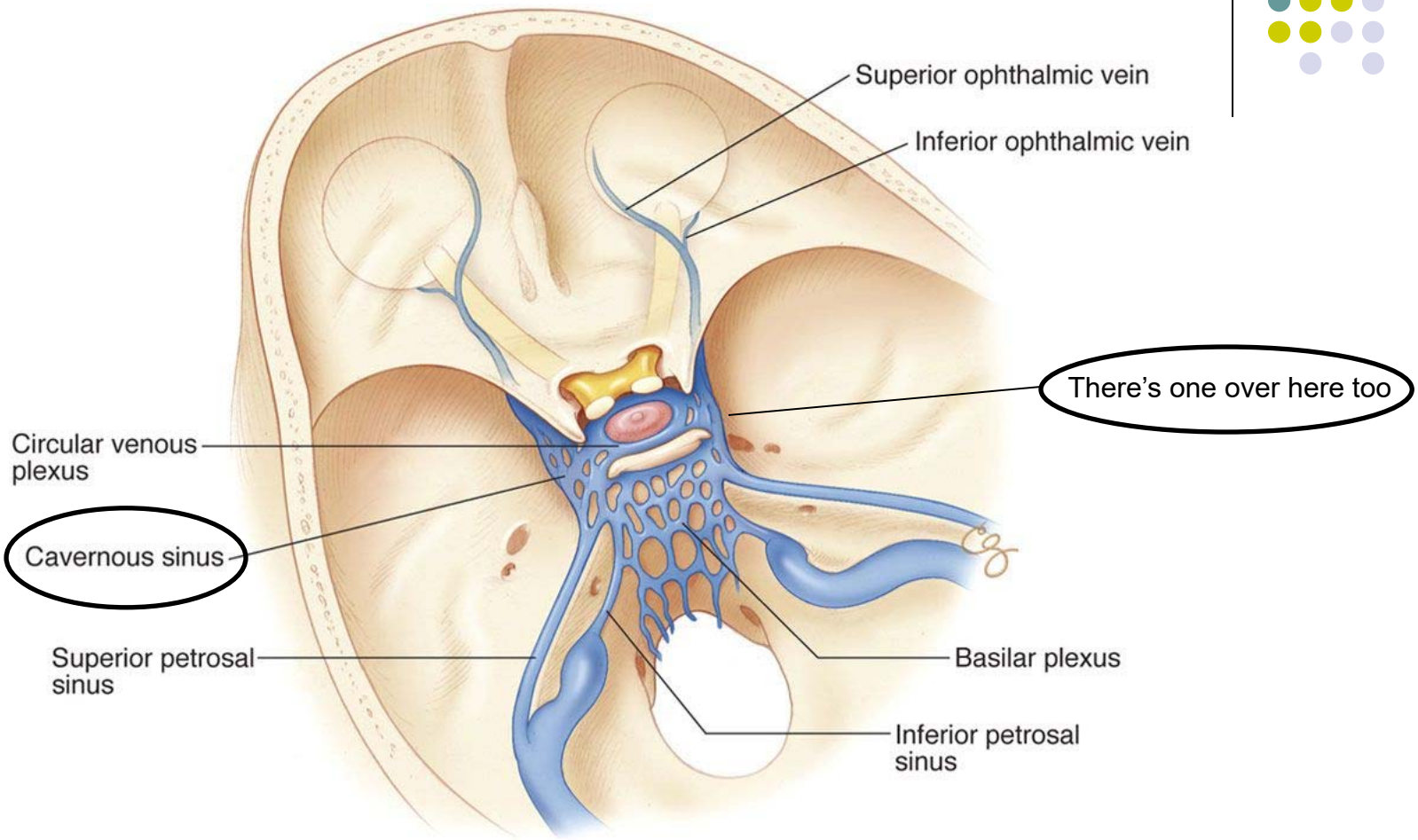
Where are they located?
Just behind the orbits, and just lateral to the sella turcica/pituitary fossa and the sphenoid sinus

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Cavernous sinuses

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?
Two

Where are they located?
Just behind the orbits, and just lateral to the **sella turcica/pituitary fossa** and the sphenoid sinus

What structure occupies the pituitary fossa?

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?
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Where are they located?
Just behind the orbits, and just lateral to the **sella turcica/pituitary fossa** and the sphenoid sinus

What structure occupies the pituitary fossa?
The pituitary gland, duh

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?
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Where are they located?
Just behind the orbits, and just lateral to the **sella turcica/pituitary fossa** and the sphenoid sinus

What structure occupies the pituitary fossa?
The pituitary gland, duh

What does this anatomic arrangement indicate regarding pituitary pathology and the CS?

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?
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Where are they located?
Just behind the orbits, and just lateral to the **sella turcica/pituitary fossa** and the sphenoid sinus

What structure occupies the pituitary fossa?
The pituitary gland, duh

What does this anatomic arrangement indicate regarding pituitary pathology and the CS?
It implies that pituitary pathology can directly impact one or both CSs

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?
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Where are they located?
Just behind the orbits, and just lateral to the sella turcica/pituitary fossa and the sphenoid sinus

In a nutshell, what sort of structure is the CS?

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ◄——————————————————► *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?
Two

Where are they located?
Just behind the orbits, and just lateral to the sella turcica/pituitary fossa and the sphenoid sinus

In a nutshell, what sort of structure is the CS?
A venous sinus--one of a number responsible for draining the cranial vault

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?

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Are the two CSs isolated, or in communication with one another?

Where are
Just behin
turcica/pitu

In a nutshell, what sort of structure is the CS?
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Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?

Two

Are the two CSs isolated, or in communication with one another?
They are in communication via numerous venous connections

Where are
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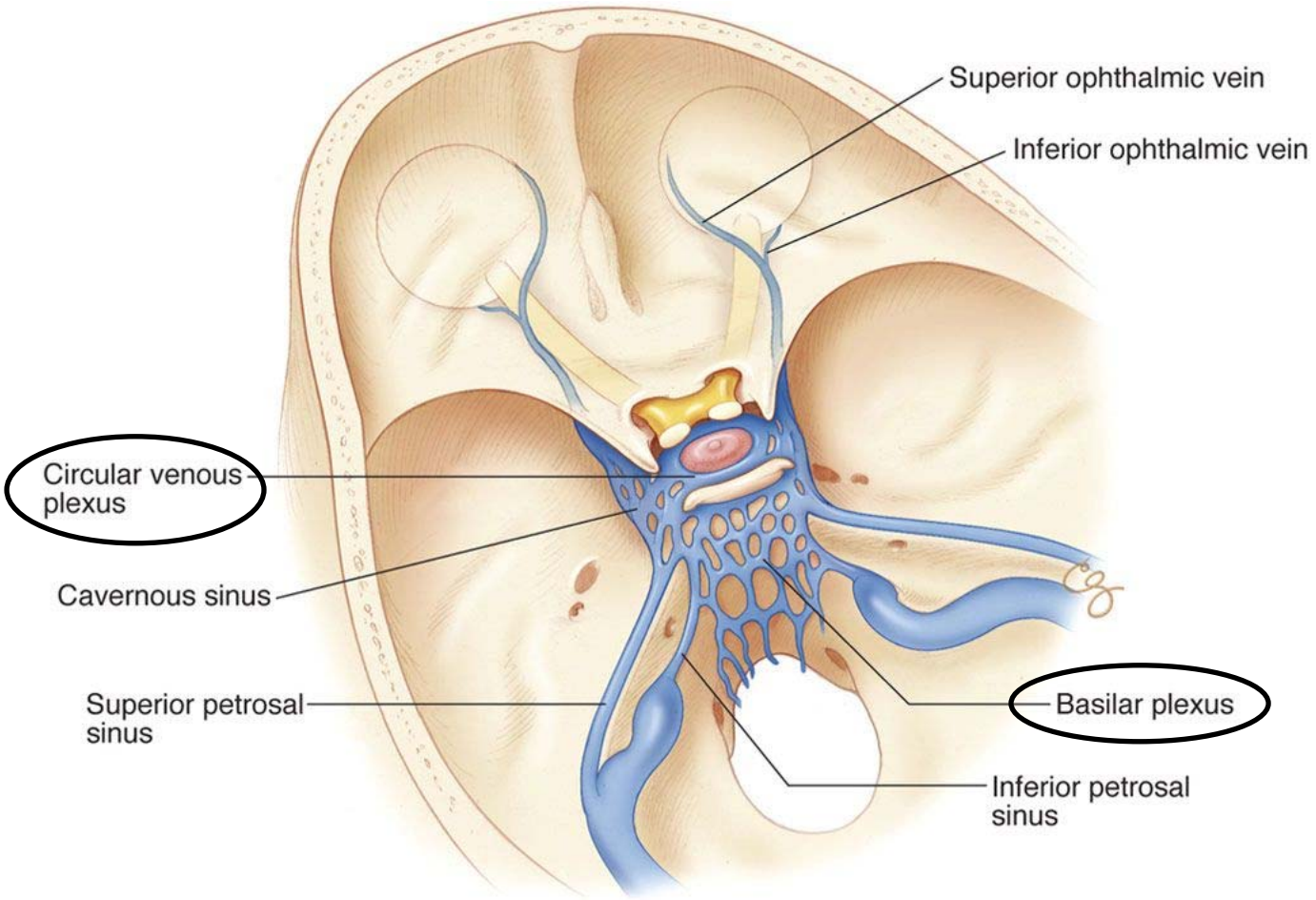
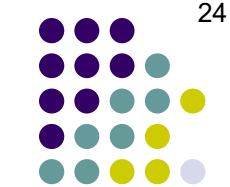
In a nutshell, what sort of structure is the CS?
A **venous sinus**--one of a number responsible for draining the cranial vault

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Cav sinuses: Interconnections
(FWIW, I don't think you need to know the plexus names)

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus | Superior orbital fissure | Orbital apex

How many CSs are in a standard human head?

Two

Are the two CSs isolated, or in communication with one another?
They are in communication via numerous venous connections

Was this a rando anatomy question, or is this fact of clinical significance?

Where are
Just behin
turcica/pitu

In a nutshell, what sort of structure is the CS?
A **venous sinus**--one of a number responsible for draining the cranial vault

Motility Disorders: *The Sinus, the Fissure, and the Apex*

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Cavernous sinus Superior orbital fissure Orbital apex

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Where are
Just behin
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Was this a rando anatomy question, or is this fact of clinical significance?
The latter, as it explains how pathologic processes can spread from one CS to the other

In a nutshell, what sort of structure is the CS?
A **venous sinus**--one of a number responsible for draining the cranial vault

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ◄——————————————————————► *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?
Two

Where are they located?
Just behind the orbits, and just lateral to the sella turcica/pituitary fossa and the **sphenoid sinus**

In a nutshell, what sort of structure is the CS?
A **venous sinus**--one draining the cranial vault

Is the sphenoid sinus another venous sinus?

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ◄——————————————————————► *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

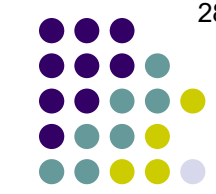
How many CSs are in a standard human head?
Two

Where are they located?
Just behind the orbits, and just lateral to the sella turcica/pituitary fossa and the **sphenoid sinus**

In a nutshell, what sort of structure is the CS?
A **venous sinus**--one of several channels responsible for draining the cranial vault

Is the sphenoid sinus another venous sinus?
No, it is one of the four paranasal air sinuses

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

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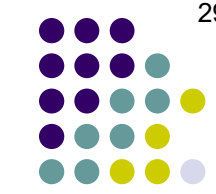
In a nutshell, what sort of structure is the CS?
A **venous sinus**--one draining the cranial vault

Is the sphenoid sinus another venous sinus?
No, it is one of the **four paranasal air sinuses**

What are the other three?

--Sphenoid sinus
-- ***?*** sinuses
-- ***?*** sinuses
-- ***?*** sinuses

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

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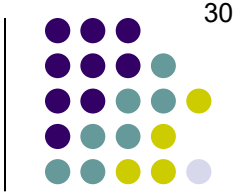
In a nutshell, what sort of structure is the CS?
A **venous sinus**--one draining the cranial vault

Is the sphenoid sinus another venous sinus?
No, it is one of the **four paranasal air sinuses**

What are the other three?

--Sphenoid sinus
--Frontal sinuses
--Ethmoid sinuses
--Maxillary sinuses

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

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A **venous sinus**--one draining the cranial vault

Is the sphenoid sinus another venous sinus?
No, it is one of the **four paranasal air sinuses**

What are the other three?
Relative to the eyes, where is each located?
--Sphenoid sinus: ***?*** the eyes
--Frontal sinuses: ***?*** the eyes
--Ethmoid sinuses: ***?*** the eyes
--Maxillary sinuses: ***?*** the eyes

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

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A **venous sinus**--one draining the cranial vault

Is the sphenoid sinus another venous sinus?
No, it is one of the **four paranasal air sinuses**

What are the other three?
Relative to the eyes, where is each located?
--Sphenoid sinus: **behind** the eyes
--Frontal sinuses: **above** the eyes
--Ethmoid sinuses: **between** the eyes
--Maxillary sinuses: **below** the eyes

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ◄——————————————————————► *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?
Two

Where are they located?
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In a nutshell, what sort of structure is the CS?
A venous sinus--one of a number responsible for draining the cranial vault

Into what vessels do the sinuses ultimately drain; ie, how does intracranial blood get out of the head?

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ◄——————————————————————► *Anterior*

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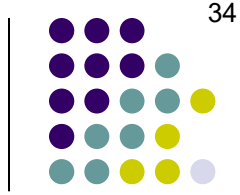
Into what vessels do the sinuses ultimately drain; ie, how does intracranial blood get out of the head?
The internal jugular (IJ) veins

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?
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Into what vessels do the sinuses ultimately drain; ie, how does intracranial blood get out of the head?
The internal jugular (IJ) veins

What structure is the main conduit for blood leaving the CS to get to the IJ vein?

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

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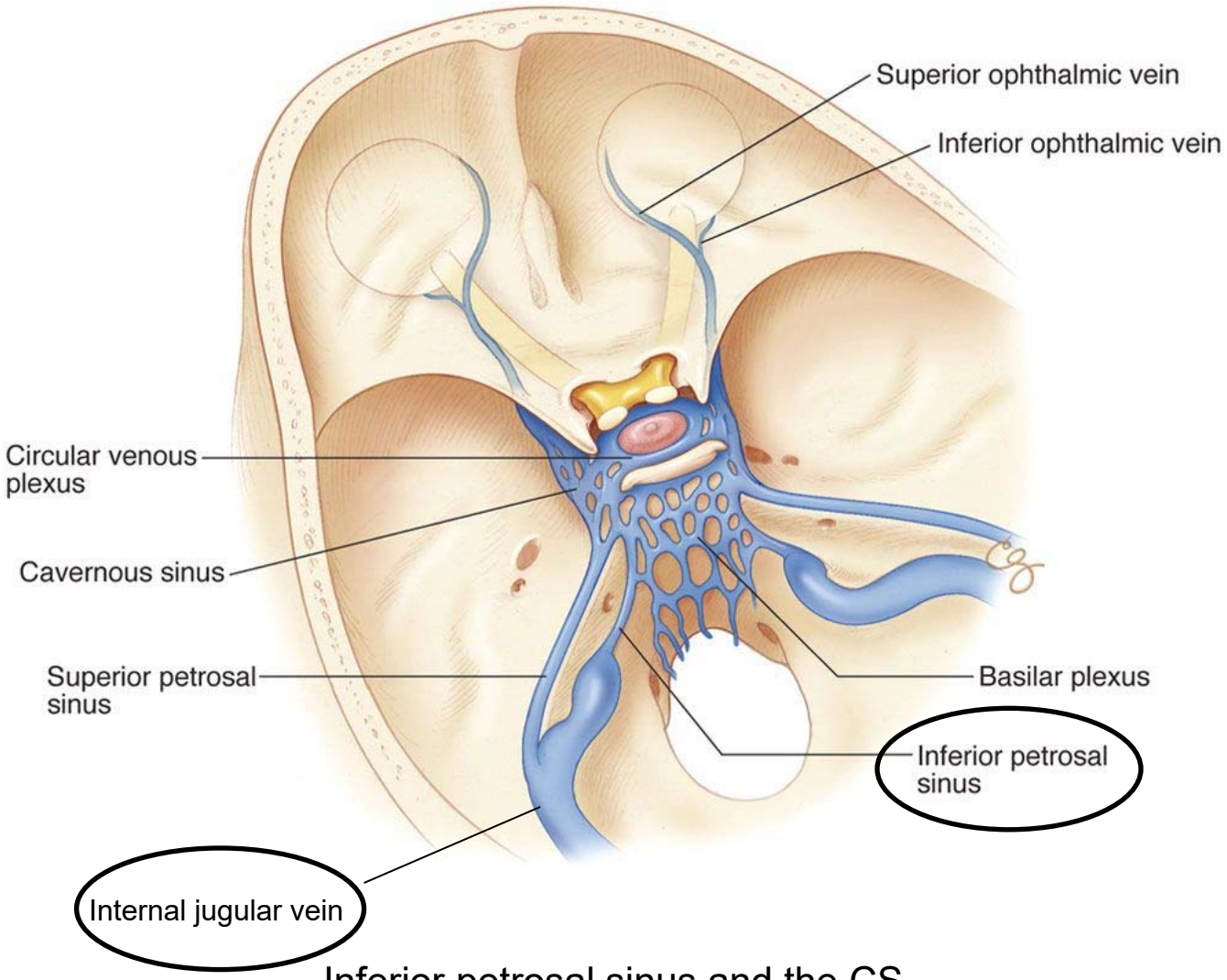
What structure is the main conduit for blood leaving the CS to get to the IJ vein?
The inferior petrosal sinus

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Inferior petrosal sinus and the CS

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?
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Where are they located?
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A venous sinus--one of a number responsible for draining the cranial vault

Into what vessels do the sinuses ultimately drain; ie, how does intracranial blood get out of the head?
The internal jugular (IJ) veins

What structure is the main conduit for blood leaving the CS to get to the IJ vein?
The inferior petrosal sinus

Through what eponymous space does the inferior petrosal sinus run?

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

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Into what vessels do the sinuses ultimately drain; ie, how does intracranial blood get out of the head?
The internal jugular (IJ) veins

What structure is the main conduit for blood leaving the CS to get to the IJ vein?
The inferior petrosal sinus

Through what eponymous space does the inferior petrosal sinus run?
Dorello's canal

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

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What structure is the main conduit for blood leaving the CS to get to the IJ vein?
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Through what eponymous space does the inferior petrosal sinus run?
Dorello's canal

Which cranial nerve travels in Dorello's canal on its way to the CS?

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

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Through what eponymous space does the inferior petrosal sinus run?
Dorello's canal

Which cranial nerve travels in Dorello's canal on its way to the CS? **CN6**

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?
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In a nutshell, what sort of structure is the CS?
A venous sinus, one of a number responsible for dra

Was **this** *a set of rando anatomy questions, or is there a clinical point being made here, too?*

Int
how does intracranial blood get out of the head?

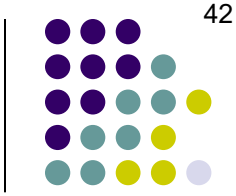
The internal jugular (IJ) veins

What structure is the main conduit for blood leaving the CS to get to the IJ vein?
The inferior petrosal sinus

Through what eponymous space does the inferior petrosal sinus run?
Dorello's canal

Which cranial nerve travels in Dorello's canal on its way to the CS? **CN6**

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?
Two

Where are they located?
Just behind the orbits, and just lateral to the sella turcica/pituitary fossa and the sphenoid sinus

In a nutshell, what sort of structure is the CS?
A venous sinus, one of a number responsible for dra

Was **this** *a set of rando anatomy questions, or is there a clinical point being made here, too?*
As before, not rando. The clinical significance here is that if CS pathology extends via the inferior petrosal sinus, it can bag CN6 in the tight confines of Dorello's canal, thereby providing another mechanism by which CS disease can produce ocular dysmotility.

Int
how does intracranial blood get out of the head?

The internal jugular (IJ) veins

What structure is the main conduit for blood leaving the CS to get to the IJ vein?
The inferior petrosal sinus

Through what eponymous space does the inferior petrosal sinus run?
Dorello's canal

Which cranial nerve travels in Dorello's canal on its way to the CS? **CN6**

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ◄——————————————————————► *Anterior*

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Into what vessels do the sinuses ultimately drain; ie, how does intracranial blood get out of the head?
The internal jugular (IJ) veins

What structures drain into the CS?

Motility Disorders: *The Sinus, the Fissure, and the Apex*

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What structures drain into the CS?
The eye and orbit (along with some intracranial blood)

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ◄——————————————————————► *Anterior*

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Motility Disorders: *The Sinus, the Fissure, and the Apex*

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The eye and orbit (a

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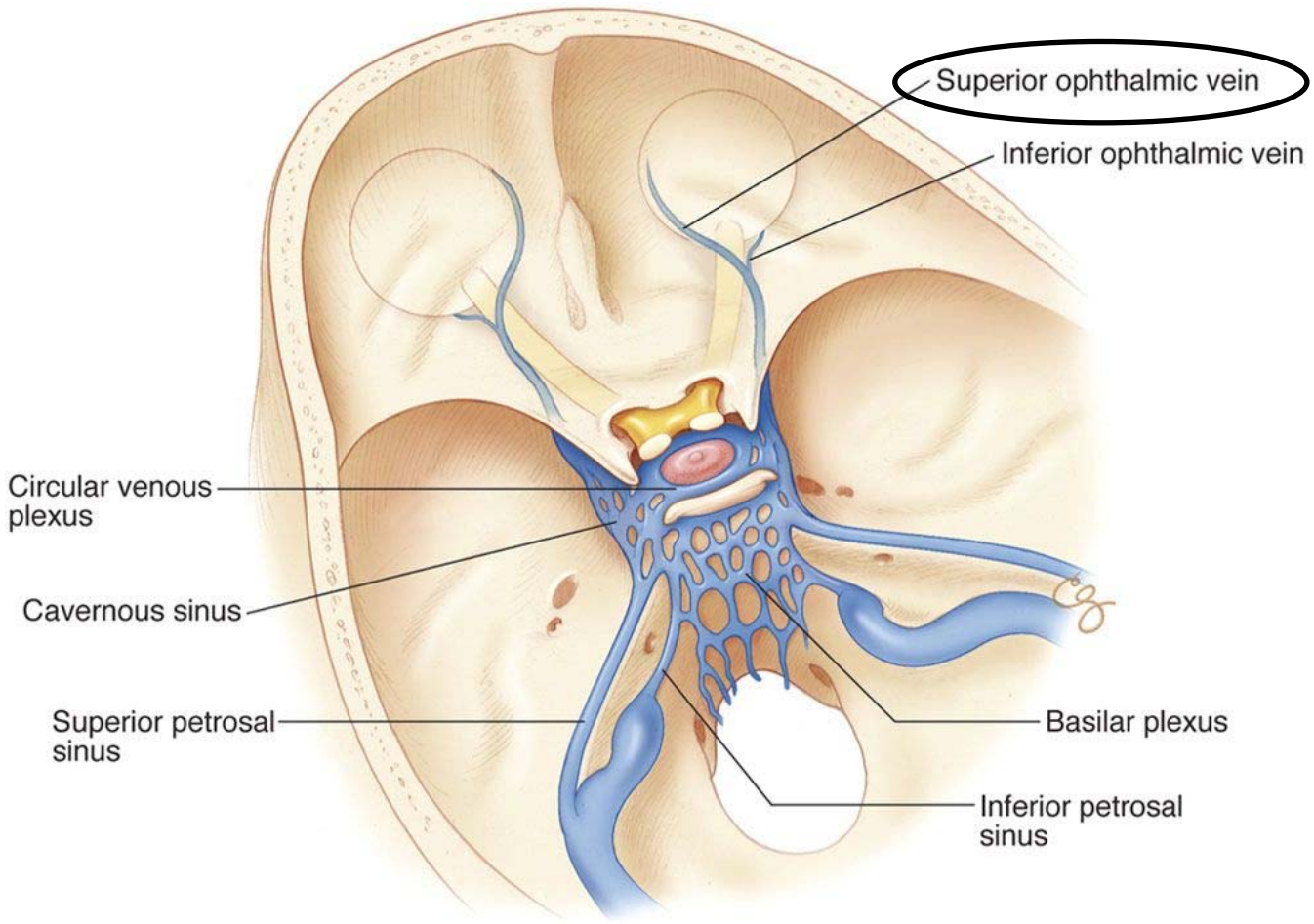
The superior ophthalmic vein

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Superior ophthalmic vein and the CS

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus Superior orbital fissure Orbital apex

A number of critical structures are located within each CS.
CN6 was alluded to a few slides ago--what are the others?

--?
--CN6
--?
--?
--?
--?
--?

Motility Disorders: *The Sinus, the Fissure, and the Apex*

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--CN4
--V1
--V2
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Motility Disorders: *The Sinus, the Fissure, and the Apex*

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--Not the...

What eye-critical structure is notable for its absence from this list?

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ← → *Anterior*

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--Postganglionic sympathetics
--Not the...optic nerves!

What eye-critical structure is notable for its absence from this list?
The optic nerve

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ◄——————————————————————► *Anterior*

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--CN3: ***?***
--CN4: ***?***
--V1: ***?***
--V2: ***?***
--Postganglionic sympathetics: ***?***

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ◄——————————————————————► *Anterior*

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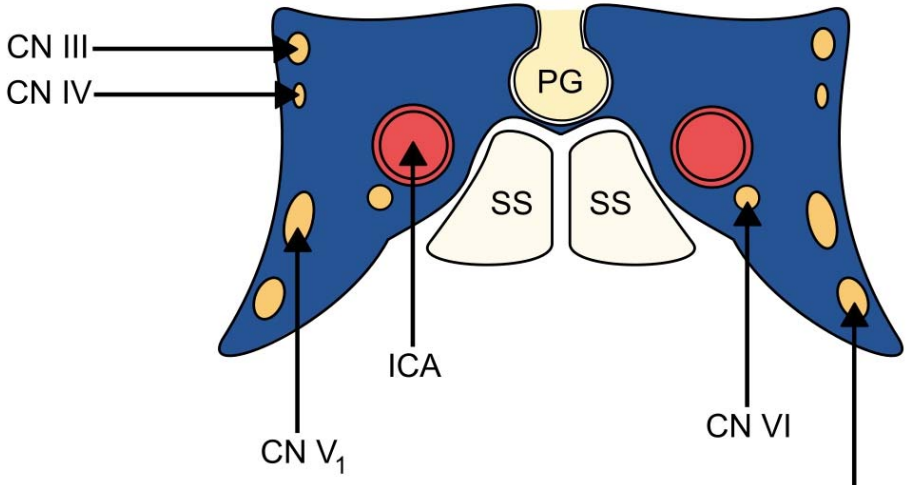
--Postganglionic sympathetics: The cavern

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Key
CN III (oculomotor nerve)
CN IV (trochlear nerve)
CN V (ophthalmic branch of the trigeminal nerve)
CN V (maxillary branch of the trigeminal nerve)
CN VI (abducent nerve)
ICA (internal carotid artery)
PG (pituitary gland)
SS (sphenoidal sinus)

Cavernous sinus, and related structures
(Not pictured: postganglionic sympathetics)

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

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Simultaneous deficits involving structures innervated by some (or all) of these nerves is highly suggestive of CS pathology

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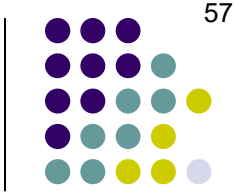
What other signs/symptoms of CS disease might be present?
--
--
--

Motility Disorders: *The Sinus, the Fissure, and the Apex*



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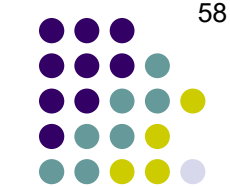
What other signs/symptoms of CS disease might be present?
--Engorged ocular surface veins
--Increased IOP
--Chemosis

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus | Superior orbital fissure | Orbital apex

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What other signs/symptoms of CS disease might be present?

--Engorged ocular surface veins
--Increased IOP
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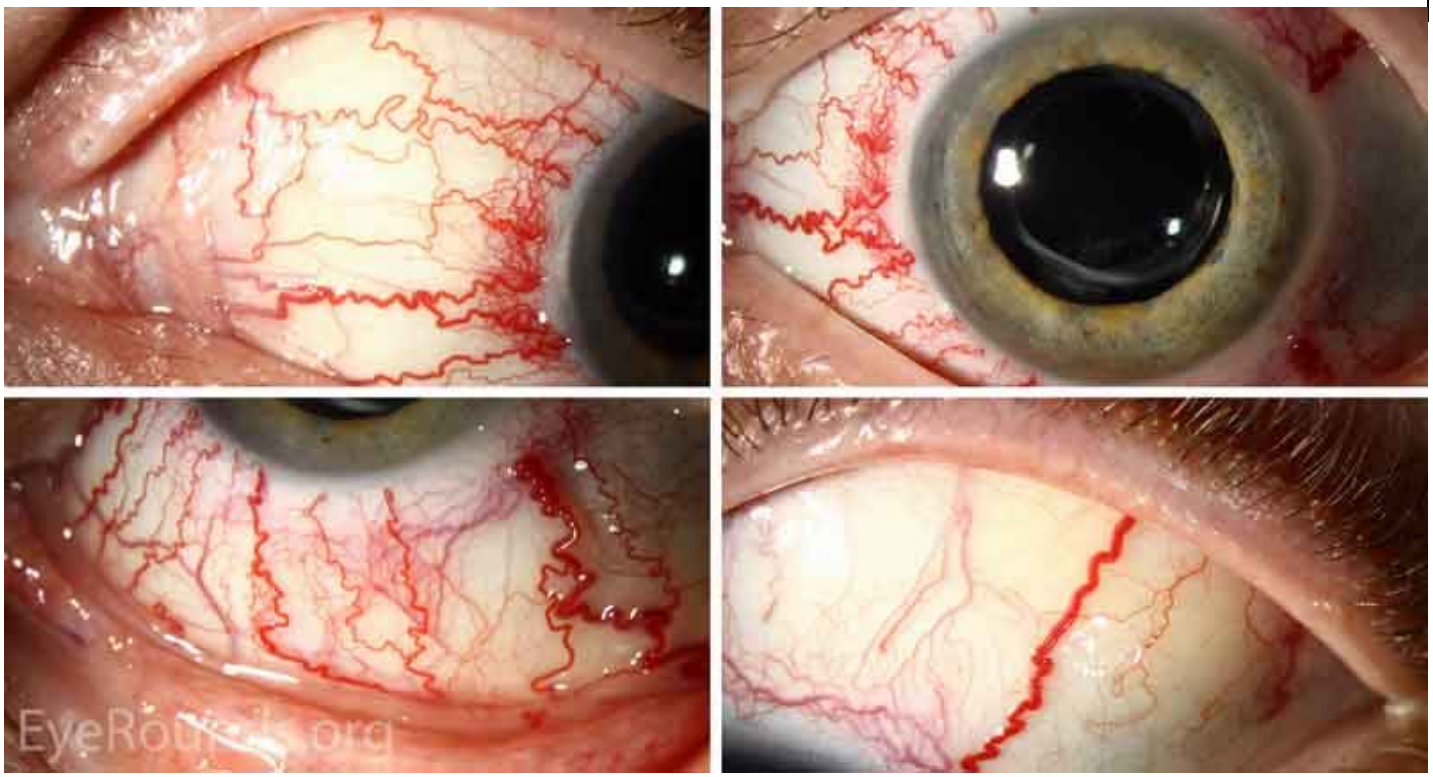
especially if signs and symptoms of orbital congestion are present as well!

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Engorged ocular surface vessels 2ndry to CS dz

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Chemosis 2ndry to CS dz

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus | Superior orbital fissure | Orbital apex

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--**CN6**: The cavern

How does CS pathology lead to orbital congestion and concomitant changes to the ocular surface, and IOP?

Simultaneous deficits involving

as

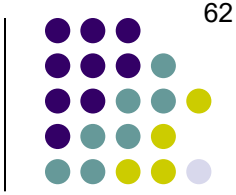
What other signs/symptoms of CS disease might be present?

if

--Engorged ocular surface veins
--Increased IOP
--Chemosis

signs and symptoms of orbital congestion are present as well!

Motility Disorders: *The Sinus, the Fissure, and the Apex*



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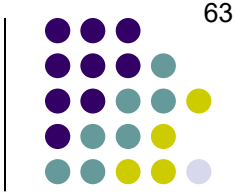
How does CS pathology lead to orbital congestion and concomitant changes to the ocular surface, and IOP?
Recall that most intraocular blood (and much orbital blood) drains into the CS via the [three words]. If CS pathology impedes venous drainage of the eye and orbit, the increased pressure on the venous side will produce the findings described.

What other signs/symptoms of CS disease might be present?
--Engorged ocular surface veins
--Increased IOP
--Chemosis

if signs and symptoms of orbital congestion are present as well!

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus | Superior orbital fissure | Orbital apex

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How does CS pathology lead to orbital congestion and concomitant changes to the ocular surface, and IOP?
Recall that most intraocular blood (and much orbital blood) drains into the CS via the superior ophthalmic vein . If CS pathology impedes venous drainage of the eye and orbit, the increased pressure on the venous side will produce the findings described.

What other signs/symptoms of CS disease might be present?
--**Engorged ocular surface veins**
--**Increased IOP**
--**Chemosis**

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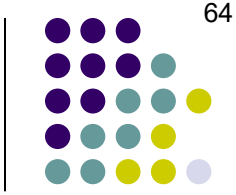
Motility Disorders: *The Sinus, the Fissure, and the Apex*



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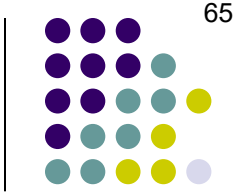
What other signs/symptoms of CS disease might be present?
--Engorged ocular surface veins
--Increased IOP
--Chemosis

Simultaneous deficits involving structures innervated by some (or all) of these nerves is highly suggestive of
CS pathology

- *?*
- *?*
- *?*

Three general categories of CS pathology:

Motility Disorders: *The Sinus, the Fissure, and the Apex*



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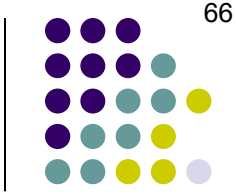
- Neoplastic
- Vascular
- Inflammatory

Three general categories of CS pathology:

Motility Disorders: *The Sinus, the Fissure, and the Apex*



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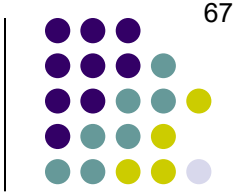
CS pathology

- **Neoplastic**

Can a neoplasia inducing a CS syndrome arise:
--As a primary in the CS?
--As a metastasis to the CS?
--In the pituitary gland, medial to the CS?
--In the ethmoid sinus, medial to the CS?
--As a sphenoid-wing meningioma, lateral to the CS?
--In an infiltrative manner, eg, from leukemia?

Motility Disorders: *The Sinus, the Fissure, and the Apex*



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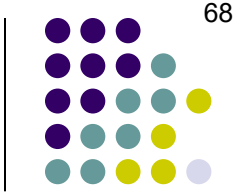
Motility Disorders: *The Sinus, the Fissure, and the Apex*



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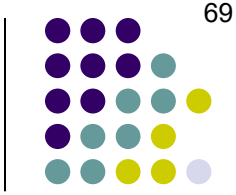
- Neoplastic
- **Vascular** → ? ?
- Inflammatory

Two broad types of CS vascular pathology:

Motility Disorders: *The Sinus, the Fissure, and the Apex*



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- Neoplastic
- **Vascular**
  - Thrombosis
  - Fistula
- Inflammatory

Two broad types of CS vascular pathology:

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- Neoplastic
- **Vascular**
  - Thrombosis (?, ?)
  - Fistula
- Inflammatory

Two types of CS thrombosis:

Motility Disorders: *The Sinus, the Fissure, and the Apex*

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- Neoplastic
- **Vascular**
  - Thrombosis
    - Septic
    - Aseptic

  Two types of CS thrombosis:
  - Fistula
- Inflammatory

Motility Disorders: *The Sinus, the Fissure, and the Apex*

In septic CS thrombosis, is the intra-cavernous infection usually primary to the sinus, or does it originate in another site?

Cav

A n
CN
Wh
--Th
--Cl
--Cl
--Cl
--V1
--V2
--Pc

What other signs/symptoms of CS disease might be present?

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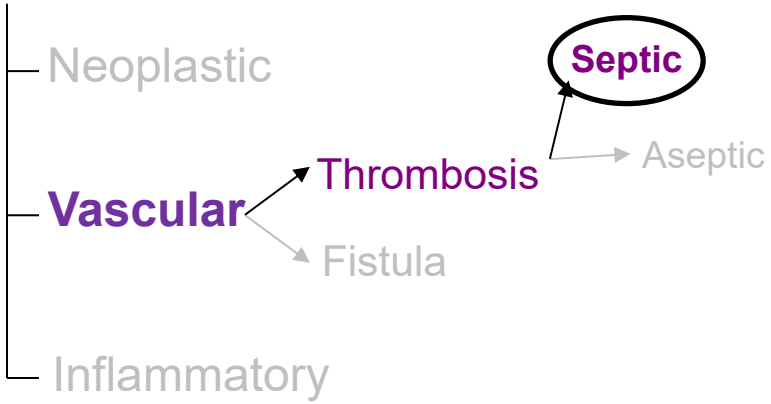

Motility Disorders: *The Sinus, the Fissure, and the Apex*

In septic CS thrombosis, is the intra-cavernous infection usually primary to the sinus, or does it originate in another site?

In most cases it originates elsewhere and spreads to the CS

Cav

A n
CN
Wh
--Th
--Cl
--Cl
--Cl
--V1
--V2
--Po

What other signs/symptoms of CS disease might be present?

--Engorged ocular surface veins
--Increased IOP
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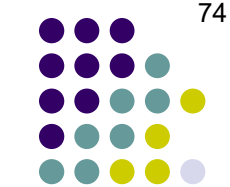
- Neoplastic
- **Vascular**
  - Thrombosis
    - **Septic**
    - Aseptic
  - Fistula
- Inflammatory

Motility Disorders: *The Sinus, the Fissure, and the Apex*



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Three sites are notorious for spreading to the CS--what are they?

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What other signs/symptoms of CS disease might be present?

--Engorged ocular surface veins

--Increased IOP

--Chemosis

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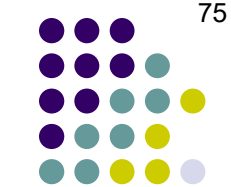

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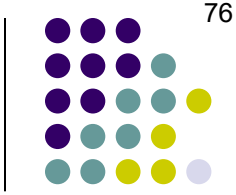

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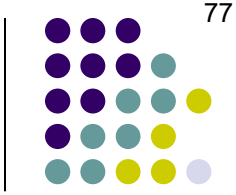

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--Orbital cellulitis?

What about orbital cellulitis--can it be the nidus for CS thrombosis?

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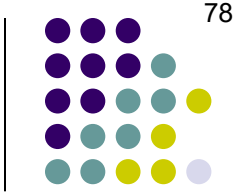
Motility Disorders: *The Sinus, the Fissure, and the Apex*



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What about orbital cellulitis--can it be the nidus for CS thrombosis?

In theory yes, but it is considered to be a very **rare** source in practice

What other signs/symptoms of CS disease might be present?

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Motility Disorders: *The Sinus, the Fissure, and the Apex*

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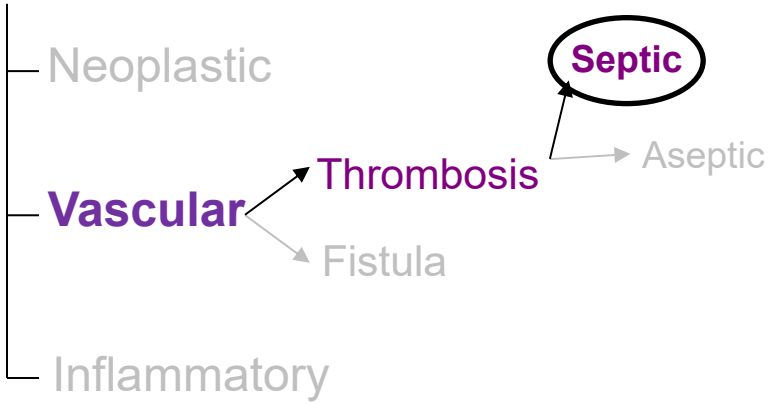
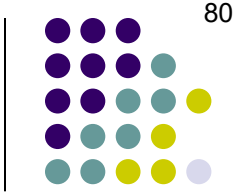


Motility Disorders: *The Sinus, the Fissure, and the Apex*



Cav

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--Cl
--V1
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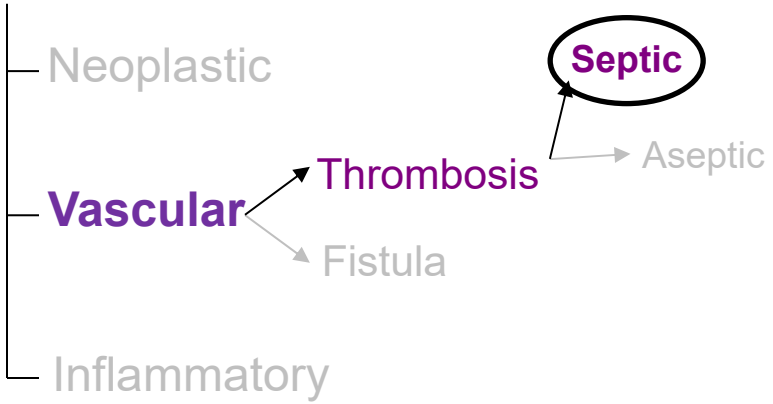

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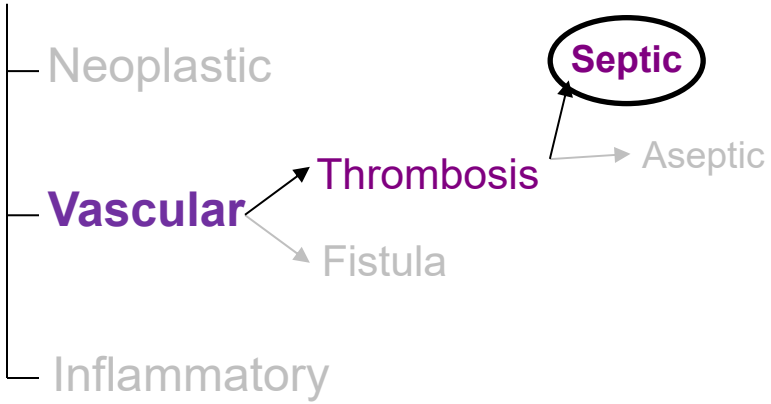

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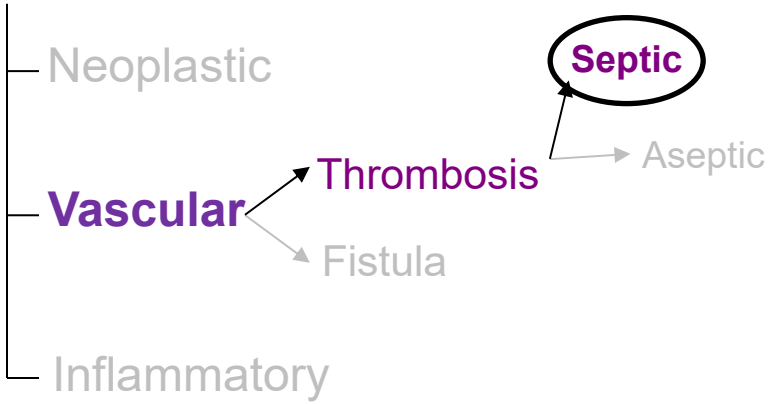

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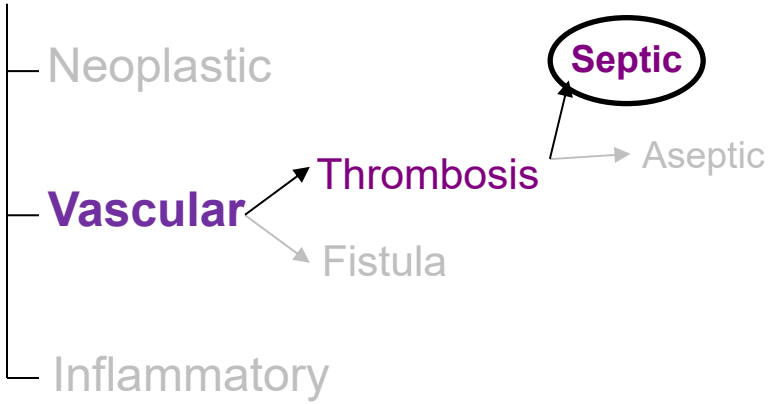

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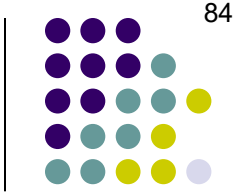

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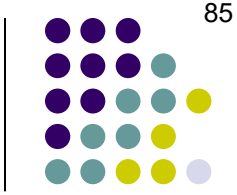

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How is septic CS thrombosis managed?

Given its high mortality rate, it should be managed as the medical emergency it is. Appropriate imaging and labs should be obtained. Broad-spectrum abx therapy should be started without delay (and probably anti-coag therapy as well). Invite your friends on the Neurosurgery and Infectious Disease services to the party.

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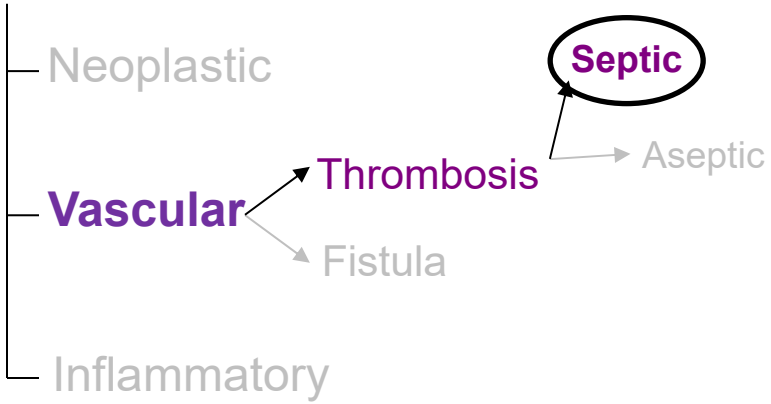

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus | Superior orbital fissure | Orbital apex

A number of critical structures are located within each CS
CN6 was alluded to a few slid
Where within the CS is each
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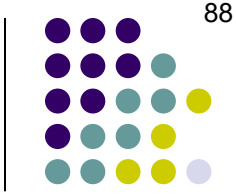

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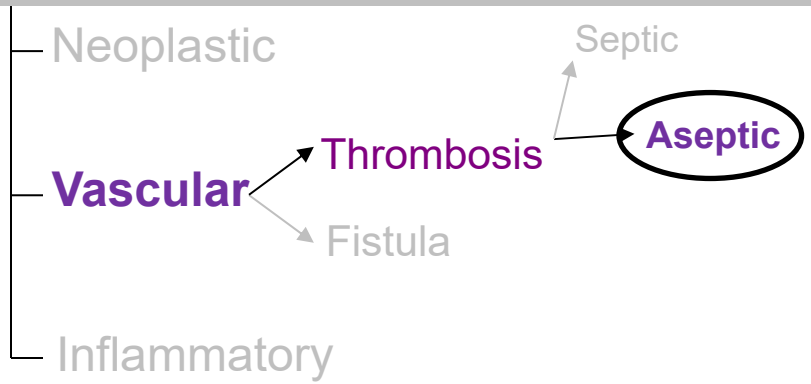

Motility Disorders: *The Sinus, the Fissure, and the Apex*

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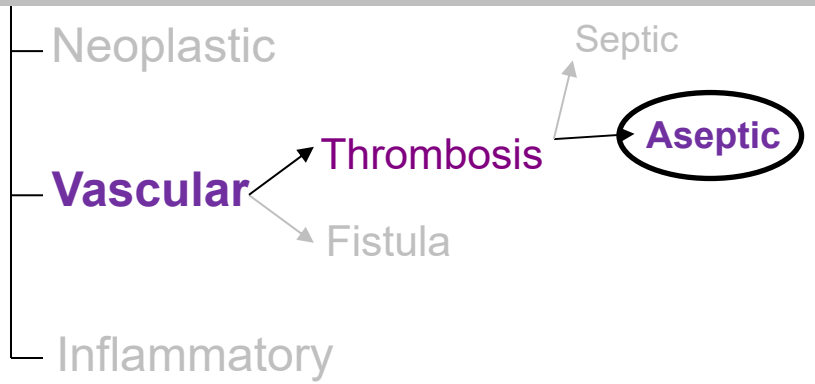

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How is it managed?
With anticoagulation/anti-platelet therapy

- Neoplastic
- **Vascular**
  - Thrombosis
    - Septic
    - **Aseptic**
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Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

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Simultaneous deficits involving structures innervated by some (or all) of these nerves is highly suggestive of

CS pathology

- Neoplastic
- **Vascular**
  - Thrombosis
    - Septic
    - Aseptic
  - Fistula
    - ?
    - ?
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Two types of CS fistula:

Motility Disorders: *The Sinus, the Fissure, and the Apex*

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    - Septic
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  - Fistula
    - High-flow
    - Low-flow
- Inflammatory

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Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟷ *Anterior*

An aspect of CS anatomy makes it uniquely vulnerable to the development of A-V fistulas. What is that aspect?

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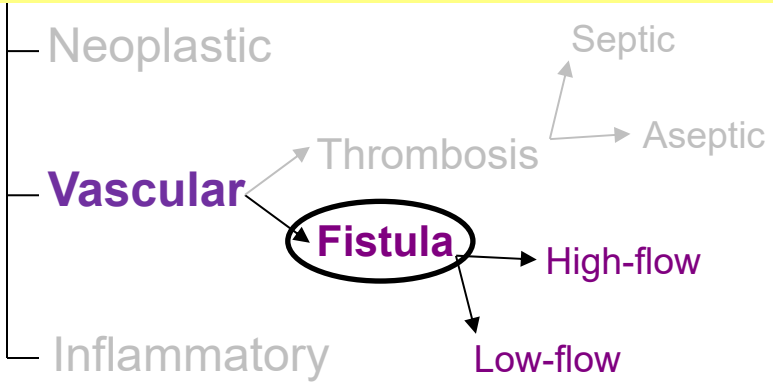

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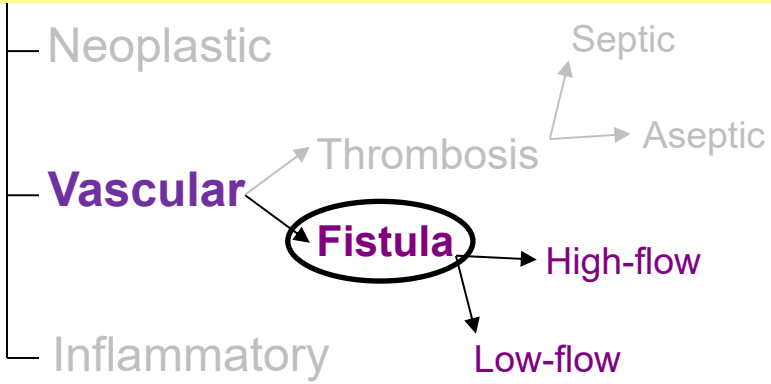

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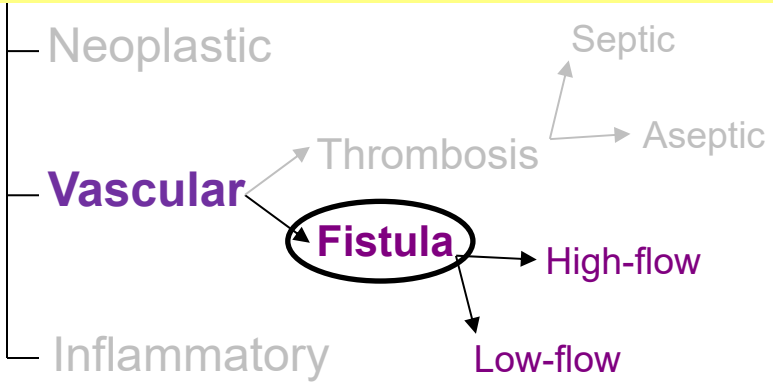

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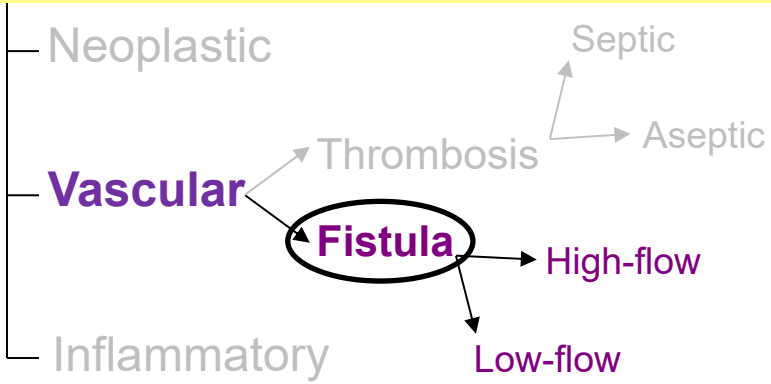


Motility Disorders: *The Sinus, the Fissure, and the Apex*

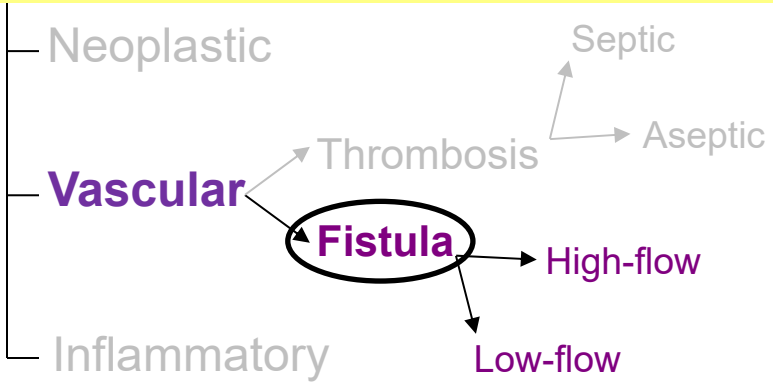
Posterior ⟵ ⟶ Anterior

An aspect of CS anatomy makes it uniquely vulnerable to the development of A-V fistulas. What is that aspect?
It is the configuration--unique in the human body--of having an *arterial* structure (the internal carotid artery and its dural branches) wholly within the confines of a *venous* structure (ie, the CS itself)

What is the fundamental problem that results from a fistula within the CS?
It's a pressure thing. A fistula allows high-pressure blood from the arterial tree to flow into the low-pressure, venous-sided CS. The subsequent increase in blood pressure within the CS impedes venous flow into the CS, leading to congestion of the eye and orbit.

What other signs/symptoms of CS disease might be present?

--Engorged ocular surface veins
--Increased IOP
--Chemosis



Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟷ Anterior

An aspect of CS anatomy makes it uniquely vulnerable to the development of A-V fistulas.
W
It i
int
str

Earlier in the slide-set, the main venous conduit from the eye and orbit to the CS was identified. What was it again?

W
It's o
the low-pressure, venous-sided CS. The subsequent increase in blood pressure within the CS **impedes venous flow into the CS, leading to congestion of the eye and orbit.**

What other signs/symptoms of CS disease might be present?

--Engorged ocular surface veins
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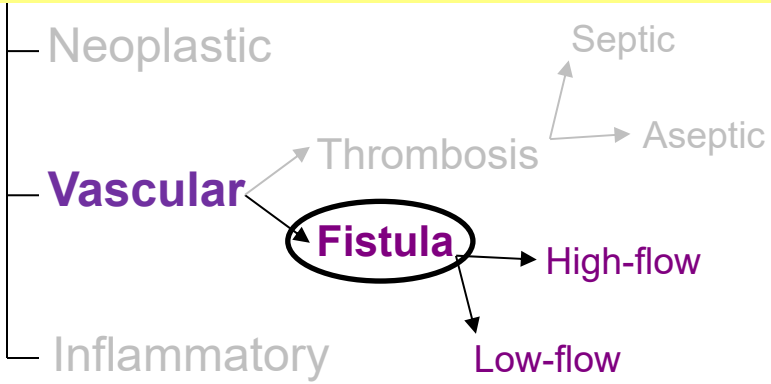

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟷ Anterior

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Earlier in the slide-set, the main venous conduit from the eye and orbit to the CS was identified. What was it again?
The superior ophthalmic vein

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What other signs/symptoms of CS disease might be present?

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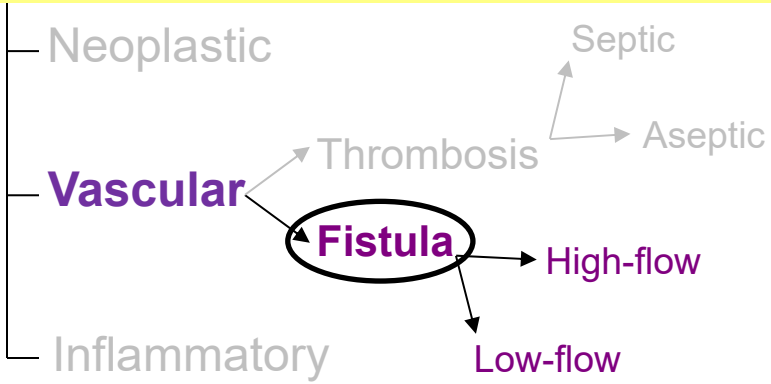

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟷ Anterior

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Earlier in the slide-set, the main venous conduit from the eye and orbit to the CS was identified. What was it again?
The superior ophthalmic vein

In a pt with a CS fistula, what is the appearance of the superior ophthalmic vein on orbital imaging studies?

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the low-pressure, venous-sided CS. The subsequent increase in blood pressure within the CS **impedes venous flow into the CS, leading to congestion of the eye and orbit.**

What other signs/symptoms of CS disease might be present?

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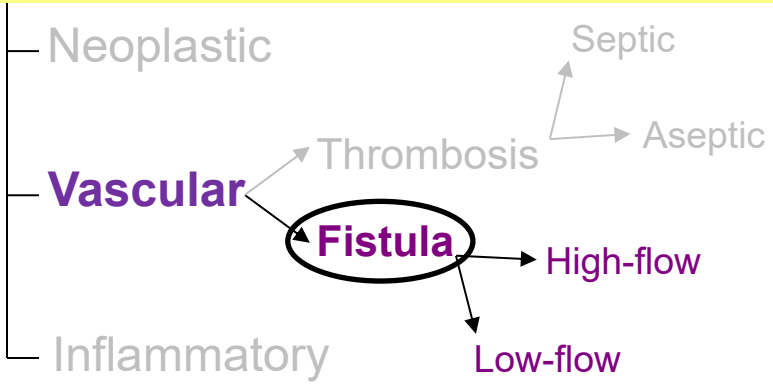

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ Anterior

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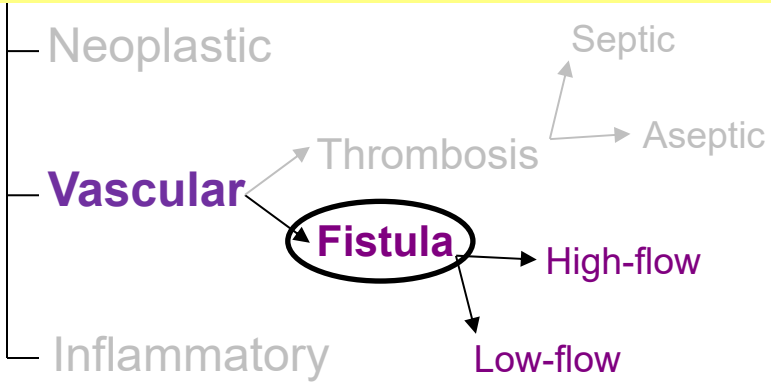
Earlier in the slide-set, the main venous conduit from the eye and orbit to the CS was identified. What was it again?
The superior ophthalmic vein

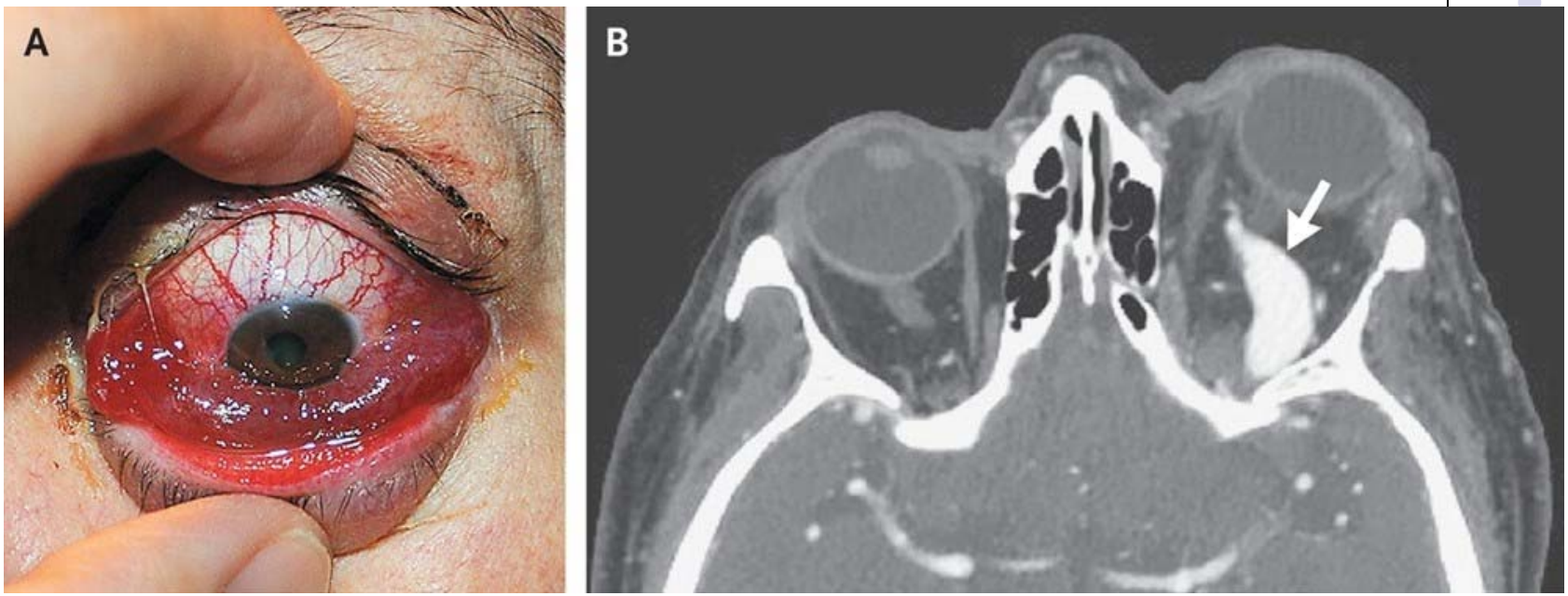
In a pt with a CS fistula, what is the appearance of the superior ophthalmic vein on orbital imaging studies?
It is enlarged. This is an important sign to search for when reviewing imaging studies in cases of suspected CS fistulas!

What other signs/symptoms of CS disease might be present?

--Engorged ocular surface veins
--Increased IOP
--Chemosis

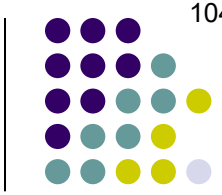


Motility Disorders: *The Sinus, the Fissure, and the Apex*



A 55 year old woman with a history of HTN presented with a 1-day history of periorbital discomfort, inferior chemosis, and conjunctival injection of the left eye (Panel A). IOP OS was 48. Exam OD was unremarkable. She reported a 2-year history of episodic headache and pulsatile tinnitus in the left ear. Contrast-enhanced computed tomography of the orbit showed proptosis and a **dilated left superior ophthalmic vein** (Panel B, arrow), suggesting the presence of a carotid–cavernous sinus fistula.

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

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What is the fundamental problem that results from a fistula within the CS?
It's a pressure thing. A fistula allows high-pressure blood from the arterial tree to flow into the low-pressure, venous-sided CS. The subsequent increase in blood pressure within the CS impedes venous flow into the CS, leading to congestion of the eye and orbit. Further, if the pressure increase within the CS is significant enough, reversal of blood flow through the venous structures that drain into the CS will occur--that is, blood will circulate **from** the CS **to** the eye and orbit.

What other signs/symptoms of CS disease might be present?
--Engorged ocular surface veins
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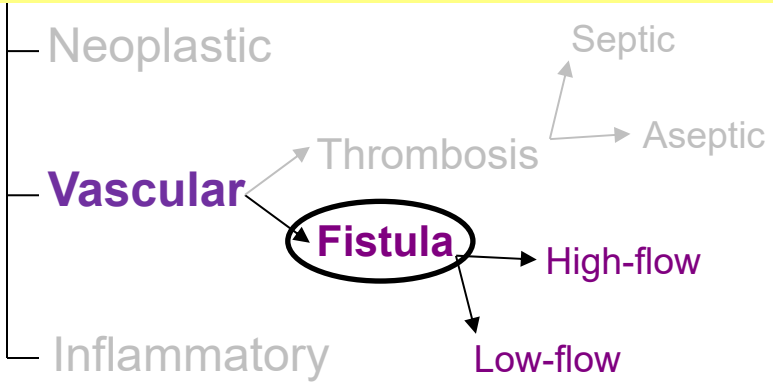

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ Anterior

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Reversal of blood produces a classic finding on the ocular surface. What is that finding?

What other signs/symptoms of CS disease might be present?
--Engorged ocular surface veins
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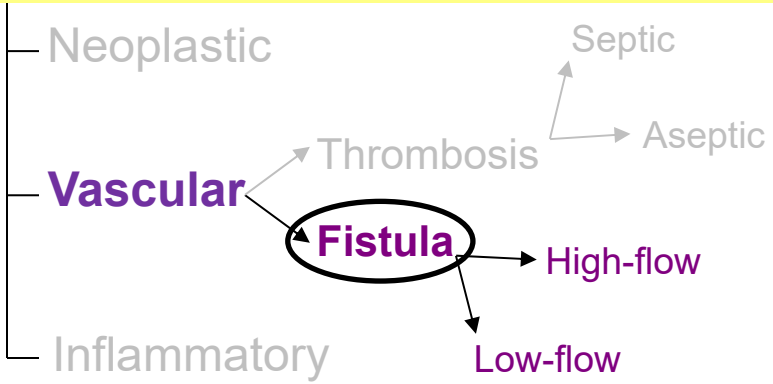

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟷ Anterior

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Reversal of blood produces a classic finding on the ocular surface. What is that finding?
Arterialization of conj vessels

What other signs/symptoms of CS disease might be present?
--Engorged ocular surface veins
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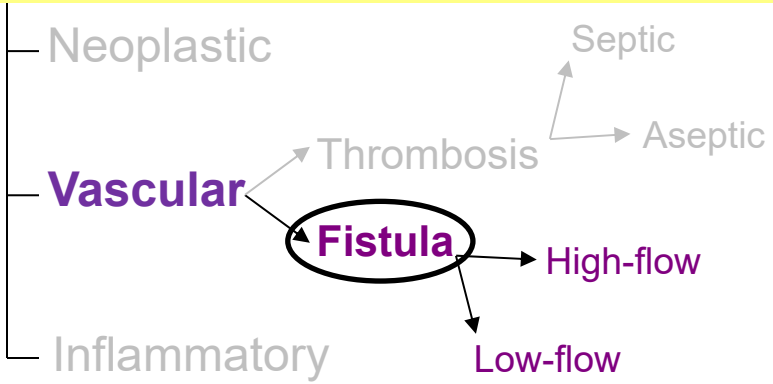
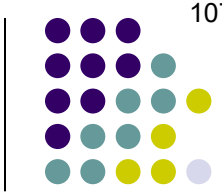


Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟷ Anterior

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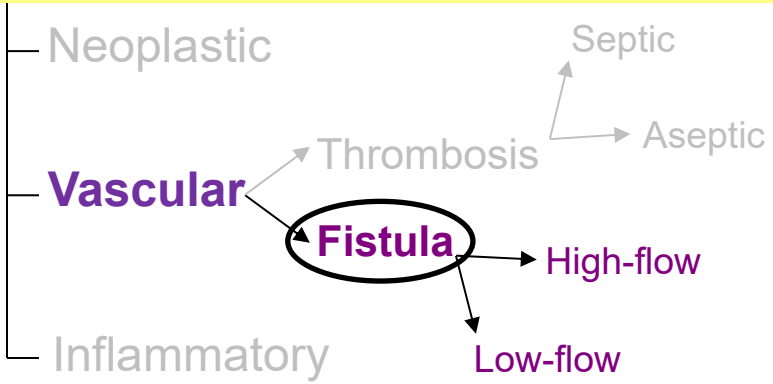
Reversal of blood produces a classic finding on the ocular surface. What is that finding?
Arterialization of conj vessels

What is the classic term used to describe the appearance of these arterialized conj vessels?

reversal of blood flow

What other signs/symptoms of CS disease might be present?
--Engorged ocular surface veins
--Increased IOP
--Chemosis



Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟷ Anterior

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Reversal of blood produces a classic finding on the ocular surface. What is that finding?
Arterialization of conj vessels

What is the classic term used to describe the appearance of these arterialized conj vessels?
'Corkscrewing'

reversal of blood flow

What other signs/symptoms of CS disease might be present?
--Engorged ocular surface veins
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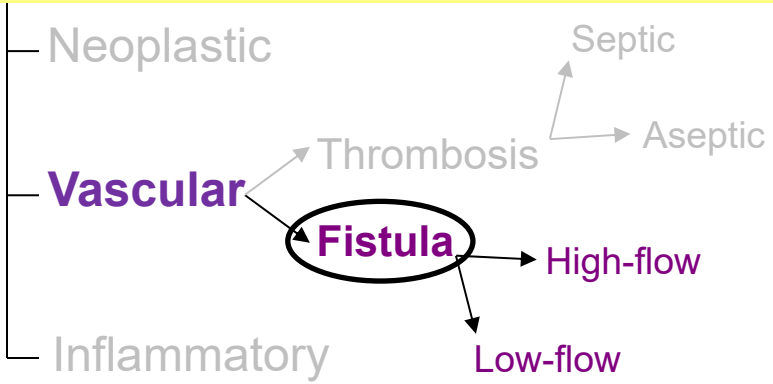
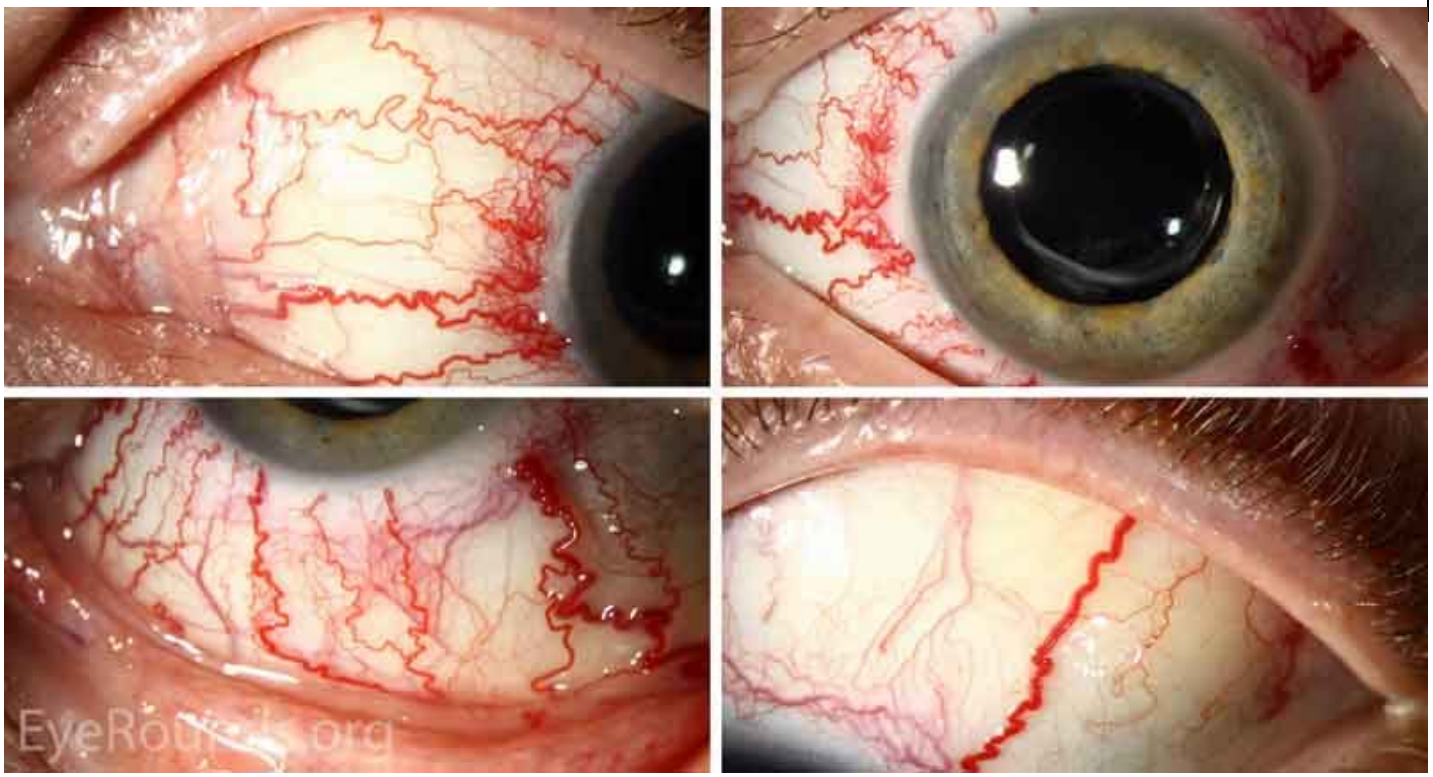


Motility Disorders: *The Sinus, the Fissure, and the Apex*



Corkscrewing of conj vessels 2ndry to CCF

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟷ *Anterior*

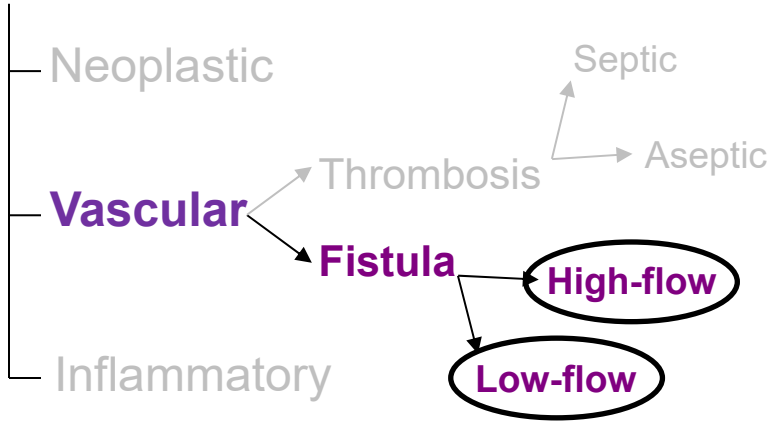
Cavernous sinus | Superior orbital fissure | Orbital apex

A number of critical structures are located within each CS.
CN6 was alluded to a few slides ago--what are the others?
Where within the CS is each located?
--The internal carotid art
--CN6: The cavern
--CN3: The lateral wall
--CN4: The lateral wall
--V1: The lateral wall
--V2: The lateral wall
--Postganglionic sympathetics:

What is the anatomic difference between low- and high-flow fistulas (other than flow rate, duh)?
A low-flow fistula involves…
whereas
a high-flow fistula involves…

What other signs/symptoms of CS disease might be present?
--Engorged ocular surface veins
--Increased IOP
--Chemosis

CS pathology



Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟷ *Anterior*

Cavernous sinus | Superior orbital fissure | Orbital apex

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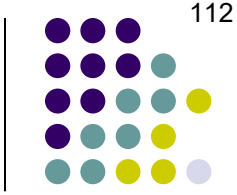
What is the anatomic difference between low- and high-flow fistulas (other than flow rate, duh)?
A low-flow fistula involves…a dural branch of the internal carotid, whereas
a high-flow fistula involves…the internal carotid itself

What other signs/symptoms of CS disease might be present?
--Engorged ocular surface veins
--Increased IOP
--Chemosis

CS pathology

- Neoplastic
- **Vascular**
  - Thrombosis
    - Septic
    - Aseptic
  - **Fistula**
    - **High-flow**
    - **Low-flow**
- Inflammatory

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus | Superior orbital fissure | Orbital apex

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--CN3: The la…
--CN4: The la…
--V1: The lateral wall
--V2: The lateral wall
--Postganglionic sympathetics:

What is the anatomic difference between low- and high-flow fistulas

What is the most common cause of high-flow fistulas?

…branch of the internal carotid,
whereas
a **high-flow fistula** …involves…the internal carotid itself

What other signs/symptoms of CS disease might be present?

--Engorged ocular surface veins
--Increased IOP
--Chemosis

CS pathology

- Neoplastic
- Vascular
  - Thrombosis
    - Septic
    - Aseptic
  - Fistula
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Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus | Superior orbital fissure | Orbital apex

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--V2: The lateral wall
--Postganglionic sympathetics:

What is the anatomic difference between low- and high-flow fistulas

What is the most common cause of high-flow fistulas?
Severe head trauma

branch of the internal carotid,
whereas
a **high-flow fistula** involves…the internal carotid itself

What other signs/symptoms of CS disease might be present?
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--Chemosis

CS pathology

- Neoplastic
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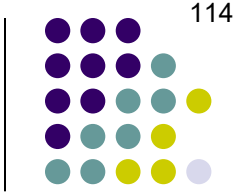
Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior → Anterior

Cavernous | Orbital apex

How about low-*flow fistulas--are they 2ndry to trauma as well?*

A number of
CN6 was allu
Where within
--The interna
--CN6: The cavern
--CN3: The lateral wall
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What other signs/symptoms of CS disease might be present?
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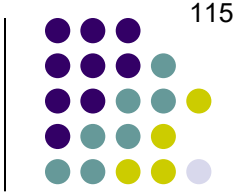
Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior → *Anterior*

Cavernous Orbital apex

How about low-*flow fistulas--are they 2ndry to trauma as well?*
No, most of these are spontaneous

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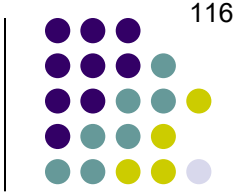
Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior → *Anterior*

Cavernous

Orbital apex

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Is there a gender predilection?

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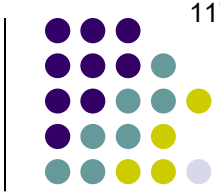
Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior → Anterior

Cavernous

Orbital apex

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Is there a gender predilection?
Yes, [redacted] are more likely to be affected

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Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior → Anterior

Cavernous | Orbital apex

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Is there a gender predilection?
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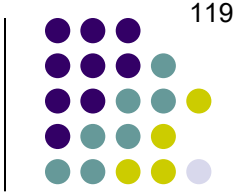
Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior → Anterior

Cavernous

Orbital apex

How about low-*flow fistulas--are they 2ndry to trauma as well?*
No, most of these are spontaneous

Is there a gender predilection?
Yes, ♀ are more likely to be affected

Is it more likely to occur in younger, or older women?

A number of
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Where within
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What other signs/symptoms of CS disease might be present?
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--Increased IOP
--Chemosis

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A **low-flow fistula** involves…a dural branch of the internal carotid, whereas
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CS pathology

- Neoplastic
- Vascular
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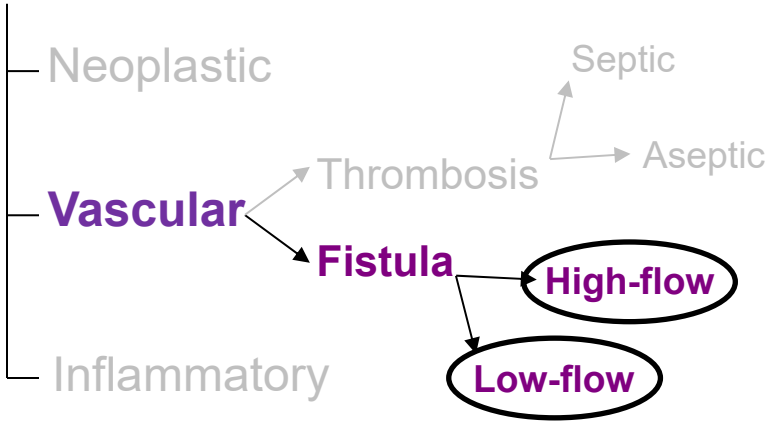

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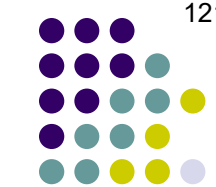

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus | Superior orbital fissure | Orbital apex

A number of critical structures are located within each CS.
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With respect to their clinical presentation, how do high- and low-flow fistulas differ?

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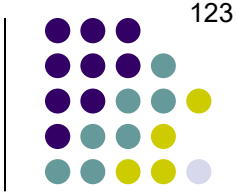

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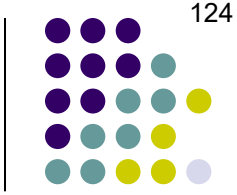

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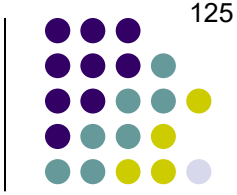

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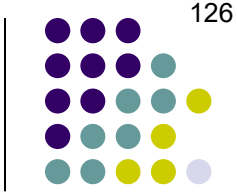

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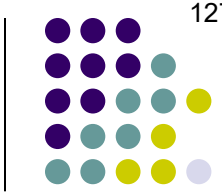

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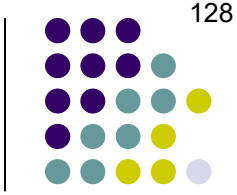

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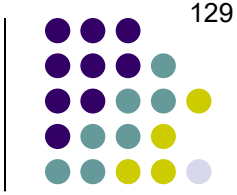

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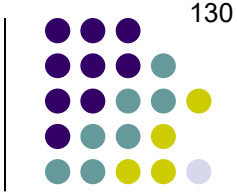

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infectious vs non

Inflammatory

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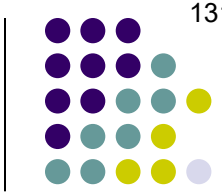

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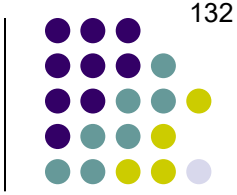

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Inflammatory

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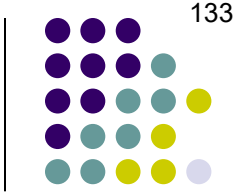

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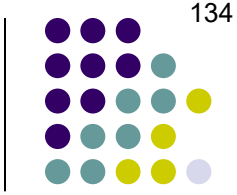

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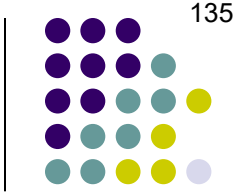

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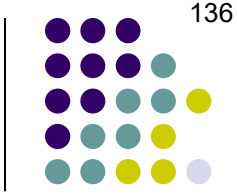

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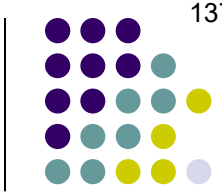

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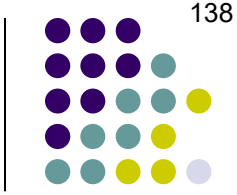

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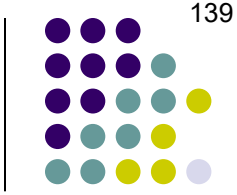
Is there an age predilection?
No

Is there a gender predilection?

Inflammatory

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ◄——————————————————► *Anterior*

Cavernous sinus

Superior orbital fissure

Orbital apex

A number of critical stru
CN6 was alluded to a fe
Where within the CS is
--The internal carotid ar
--CN6: The cavern
--CN3: The lateral wall
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--V2: The lateral wall
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What other signs/sympt
CS disease might be pr
--Engorged ocular sur
--Increased IOP
--Chemosis

The BCSC Neuro *book discusses one specific inflammatory condition by name. What is that condition?*
Tolosa-Hunt syndrome

What is the Tolosa-Hunt syndrome*?*
Painful ophthalmoplegia secondary to noninfectious inflammation of the cavernous sinus

Is it common, or rare?
Very rare

Is there an age predilection?
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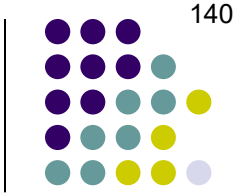
Is there a gender predilection?
No

Inflammatory

Motility Disorders: *The Sinus, the Fissure, and the Apex*



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Pa ous
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Inflammatory

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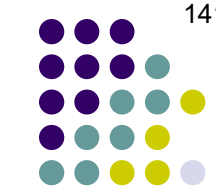

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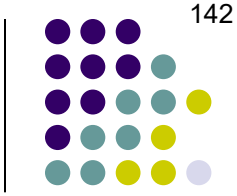

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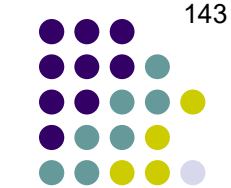

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The pain is [quick vs slow to resolve], whereas the ophthalmoplegia [quick vs slow to resolve]

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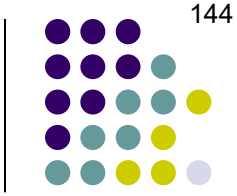

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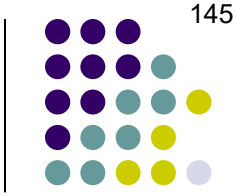

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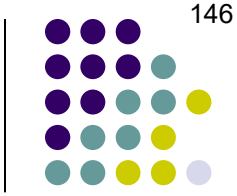

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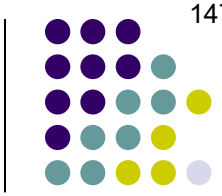

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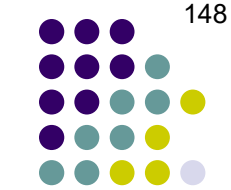

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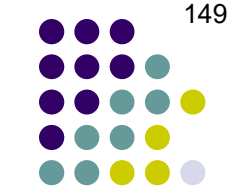

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Which neoplasm in particular?

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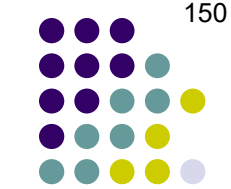

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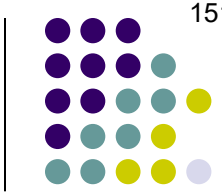

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The *Neuro* book puts it this way: "*Not infrequently, it is later discovered that the cause of the painful ophthalmoplegia in patients initially diagnosed with Tolosa-Hunt syndrome is neoplastic*."

W
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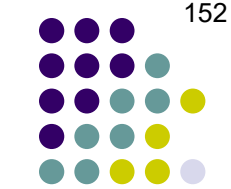

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Which type of infectious in particular?

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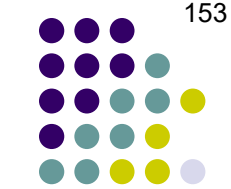

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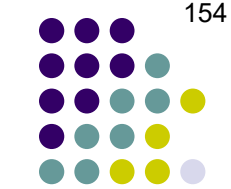

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The takeaway point: Tolosa-Hunt is vastly more likely to appear on a test than in your exam chair. So, while you should feel free to sling the diagnosis around on the OKAP, prudence dictates to be much more circumspect with it in the clinic. (Andrew Lee, among others, argues that the diagnosis should not be made by anyone other than a trained neuro-oph.)

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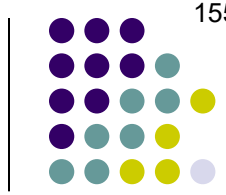

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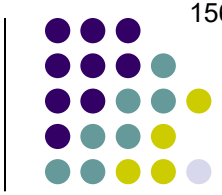
Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?

Motility Disorders: *The Sinus, the Fissure, and the Apex*



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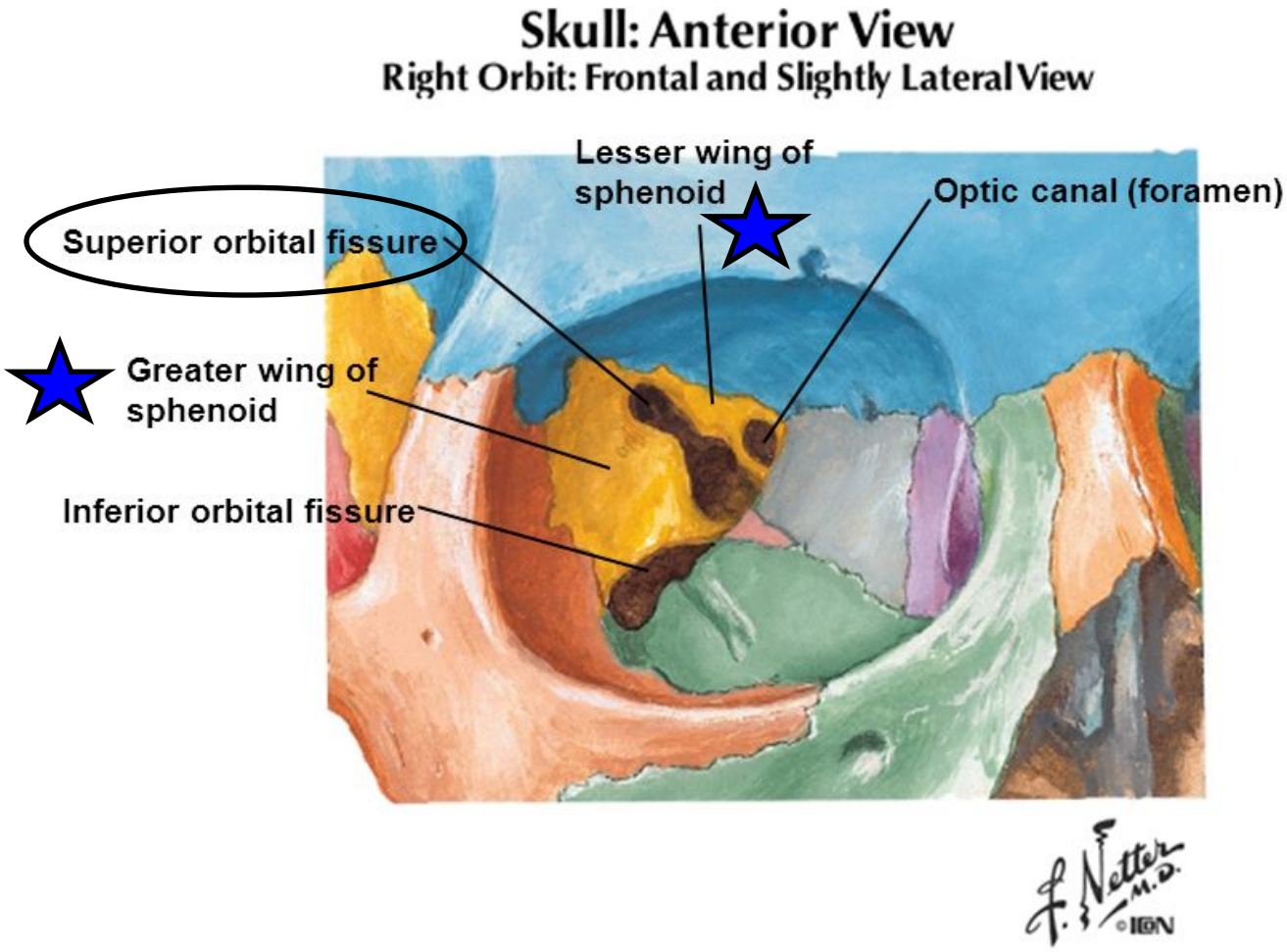
Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

Motility Disorders: *The Sinus, the Fissure, and the Apex*



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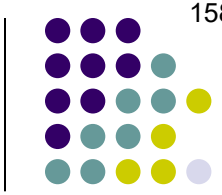

Posterior ⟵ ⟶ *Anterior*

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How long is the SOF?

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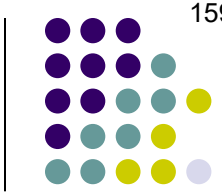


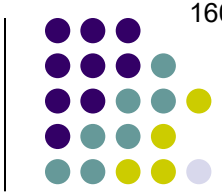
Posterior ◄——————————————————► *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

How long is the SOF?
About 2 cm

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

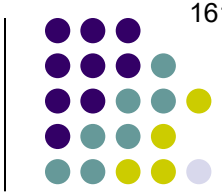
Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

How long is the SOF?
About 2 cm

The SOF is straddled by a very important structure--what is the eponymous name of this structure?

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ◄——————————————————► *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
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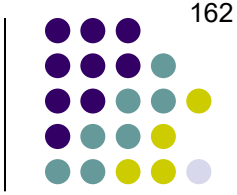
The annulus of Zinn

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

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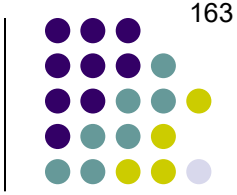
What is the annulus of Zinn?

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

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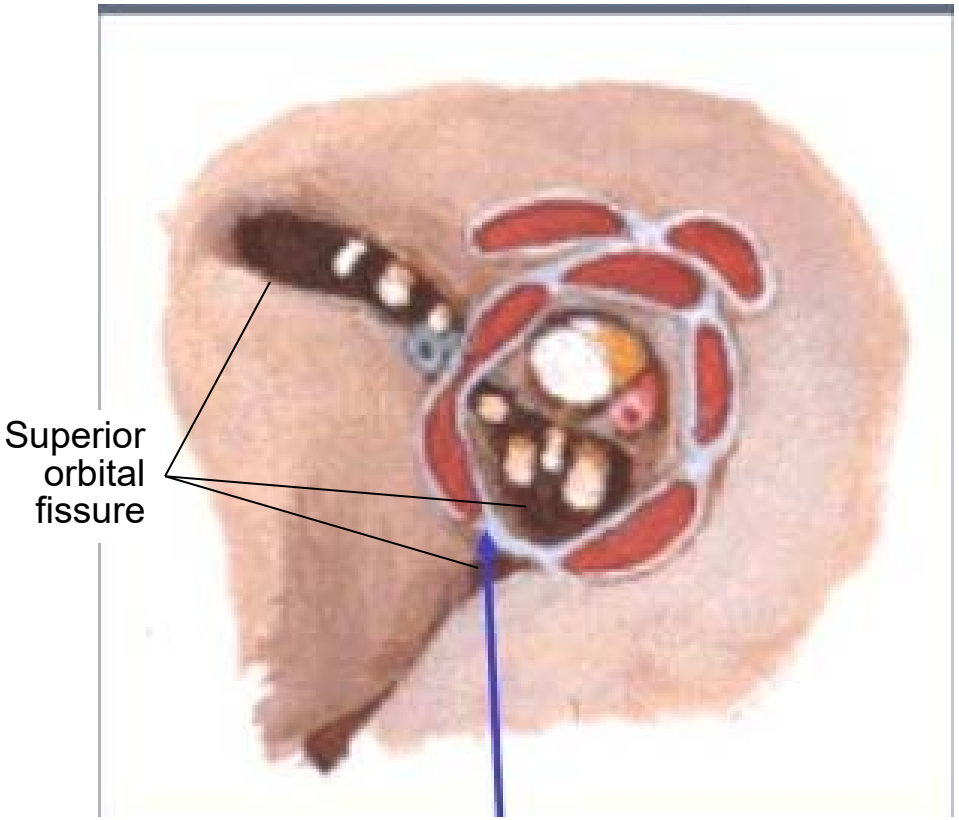
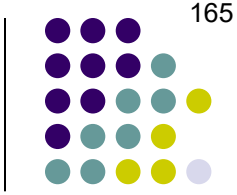
What is the annulus of Zinn?
It is a ring-shaped structure formed by the tendinous insertions of the four rectus muscles

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Superior orbital fissure and the annulus of Zinn

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

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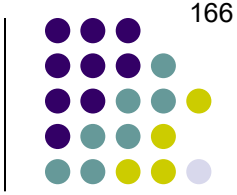
What portion of the SOF is straddled by the annulus?

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

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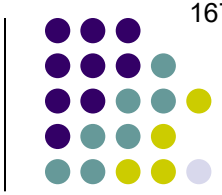
What portion of the SOF is straddled by the annulus?
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

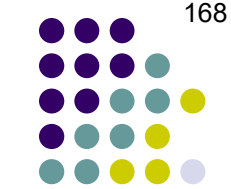
How long is the SOF?
About 2 cm

The SOF is straddled by a very important structure--what is the eponymous name of this structure?
The annulus of Zinn

By dint of its location, the annulus divides the SOF into three sections. What are they called?
--?
--?
--?

What portion of the SOF is straddled by the annulus?
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus — **Superior orbital fissure** — Orbital apex

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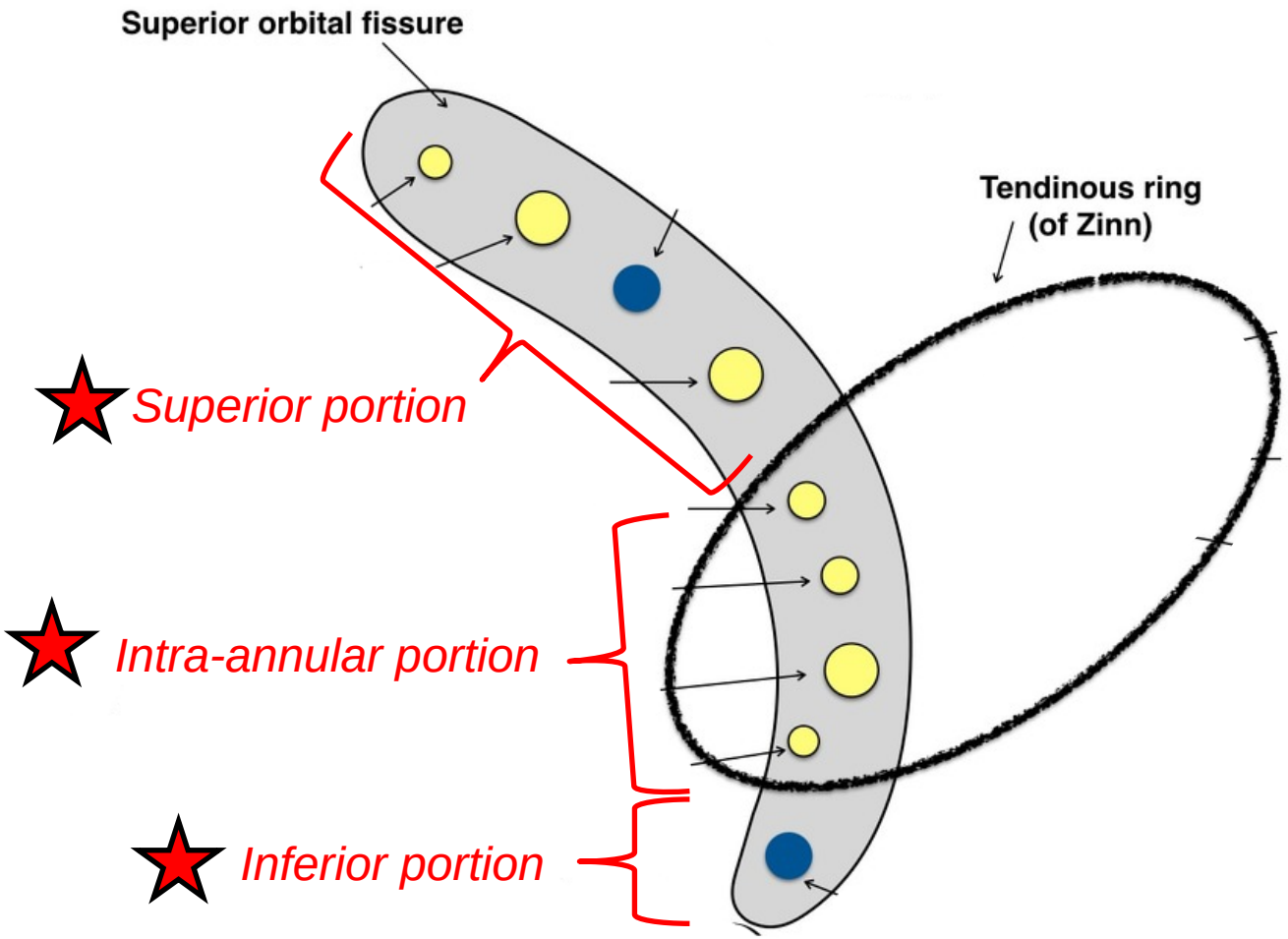
By dint of its location, the annulus divides the SOF into three sections. What are they called?
--The **superior** portion is above the annulus
--The **intra-annular** portion
--The **inferior** portion below it

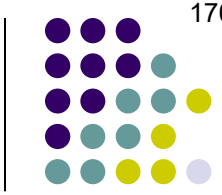
What portion of the SOF is straddled by the annulus?
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Superior orbital fissure and the annulus of Zinn

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ◄——————————————————► *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

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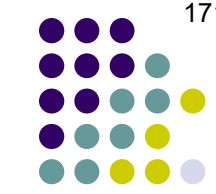
Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ◄——————————————————► *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

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About 2 cm

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What structures pass through the superior portion of the SOF?
--The [two words] vein
--The [ ] and [ ] nerves
-- [CN#]

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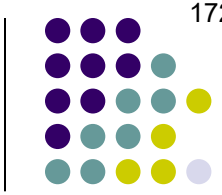
Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ◄——————————————————► *Anterior*

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What structures pass through the superior portion of the SOF?
--The superior ophthalmic vein
--The lacrimal and frontal nerves
--CN4

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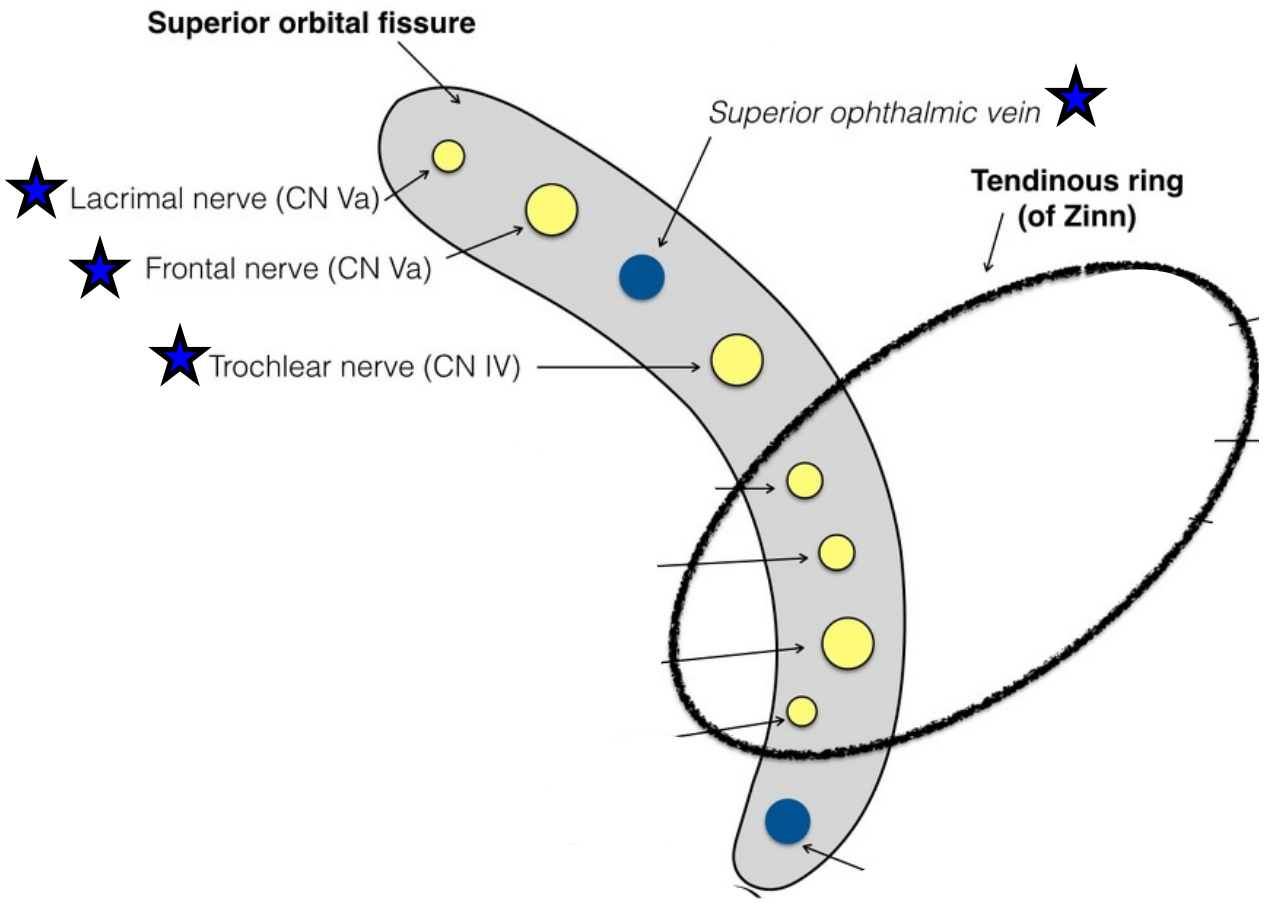
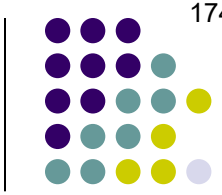
Motility Disorders: *The Sinus, the Fissure, and the Apex*



Superior orbital fissure: Superior portion

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

What sort (ie, sensory, motor, autonomic, etc) of nerves are the lacrimal and frontal?

How
Abou

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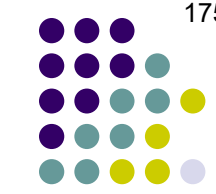
Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
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Sensory

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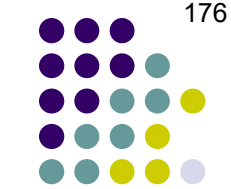
Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

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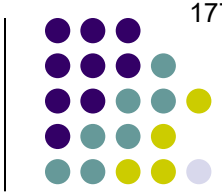

Posterior ◄——————————————————► *Anterior*

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What sort (ie, sensory, motor, autonomic, etc) of nerves are the lacrimal and frontal?
Sensory

To which cranial nerve do they belong?
CN5 , specifically V# (aka the [redacted] nerve)

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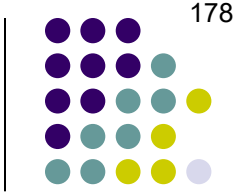

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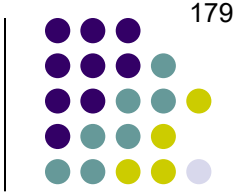

Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

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Roughly the middle third

V1/the ophthalmic nerve divides into three branches, two of which are the frontal and lacrimal. What is the other?
--***?***
--Frontal
--Lacrimal

To which cranial nerve do they belong?
CN5 , specifically **V1 (aka the ophthalmic nerve)**

What structures pass through the superior portion of the SOF?
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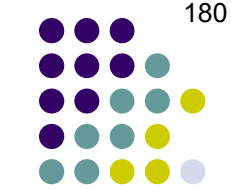
--CN4

Motility Disorders: *The Sinus, the Fissure, and the Apex*



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Roughly the middle third

V1/the ophthalmic nerve divides into three branches, two of which are the frontal and lacrimal. What is the other?
--Nasociliary
--Frontal
--Lacrimal

To which cranial nerve do they belong?
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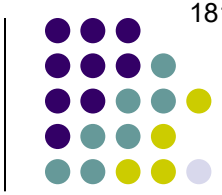
Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
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Note that the initials of the V1 branches make a good mnemonic!

V1/the ophthalmic nerve divides into three branches, two of which are the frontal and lacrimal. What is the other?
--**N** asociliary
--**F** rontal
--**L** acrimal

The
CN5 , specifically **V1 (aka the ophthalmic nerve)**

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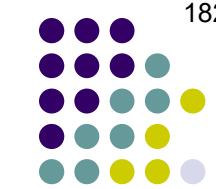

Posterior ⟵ ⟶ *Anterior*

Caver… …ital apex

What becomes of the lacrimal and frontal nerves, ie, where do they go and what do they do?
The lacrimal nerve…
The frontal nerve…

…gs of

*What sort (ie, sensory, motor, autonomic, etc) of nerves are the **lacrimal and frontal**?*
Sensory

To which cranial nerve do they belong?
CN5 , specifically **V1 (aka the ophthalmic nerve)**

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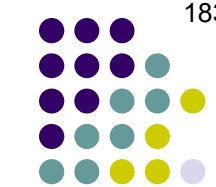
Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟷ *Anterior*

Caver… …ital apex

What becomes of the lacrimal and frontal nerves, ie, where do they go and what do they do?
The lacrimal nerve…heads toward, and is sensory to, the lacrimal gland
The frontal nerve…

…gs of

*What sort (ie, sensory, motor, autonomic, etc) of nerves are the **lacrimal and frontal**?*
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To which cranial nerve do they belong?
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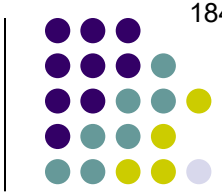
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟷ *Anterior*

Caver… …ital apex

What becomes of the lacrimal and frontal nerves, ie, where do they go and what do they do?
The lacrimal nerve…heads toward, and is sensory to, the lacrimal gland
The frontal nerve…

…gs of

*What sort (ie, sensory, motor, autonomic, etc) of nerves are the **lacrimal and frontal**?*
Sensory

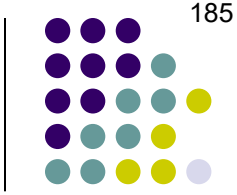
To which cranial nerve do they belong?
CN5 , specifically **V1 (aka the ophthalmic nerve)**

What structures pass through the superior portion of the SOF?
--The superior ophthalmic vein
--The **lacrimal and frontal nerves**
--CN4

By dint of its location, t…
What are they called?
--The **superior** portion is above the annulus
--The **intra-annular** portion
--The **inferior** portion below it

What portion of the SOF is straddled by the annulus?
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Caver… …ital apex

What becomes of the lacrimal and frontal nerves, ie, where do they go and what do they do?
The lacrimal nerve…heads toward, and is sensory to, the lacrimal gland
The frontal nerve…divides into two terminal branches (the [redacted] and [redacted] nerves), which are sensory to the forehead, upper lids, and a portion of the conj

…gs of

*What sort (ie, sensory, motor, autonomic, etc) of nerves are the **lacrimal and frontal**?*
Sensory

To which cranial nerve do they belong?
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Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*

Posterior ← → *Anterior*

Caver... Orbital apex

What becomes of the lacrimal and frontal nerves, ie, where do they go and what do they do?
The lacrimal nerve…heads toward, and is sensory to, the lacrimal gland
The frontal nerve…divides into two terminal branches (the supraorbital and supratrochlear nerves), which are sensory to the forehead, upper lids, and a portion of the conj

...gs of

What sort (ie, sensory, motor, autonomic, etc) of nerves are the ***lacrimal and frontal****?*
Sensory

To which cranial nerve do they belong?
CN5 , specifically **V1 (aka the ophthalmic nerve)**

How...
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The annu...

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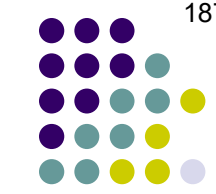
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ◄——————————————————► *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

How long is the SOF?
About 2 cm

The SOF is straddled by a very important structure--
what is the ep
The annulus o

What structures pass through the annulus itself?
--?
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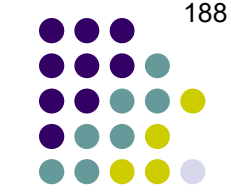
By dint of its location, the ar
What are they called?
--The **superior** portion is above the annulus
--The **intra-annular** portion
--The **inferior** portion below it

What portion of the SOF is straddled by the annulus?
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ◄——————————————————► *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

How long is the SOF?
About 2 cm

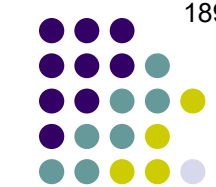
The SOF is straddled by a very important structure--
what is the ep
The annulus

What structures pass through the annulus itself?
--The nasociliary nerve
--CN3
--CN6

By dint of its location, the ar
What are they called?
--The **superior** portion is above the annulus
--The **intra-annular** portion
--The **inferior** portion below it

What portion of the SOF is straddled by the annulus?
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

How long is the SOF?
About 2 cm

Is CN3 a single entity as it passes through the SOF?

Th
wh
nulus itself?
The annulus
--The nasociliary nerve
--**CN3**
--CN6

By dint of its location, the ar
What are they called?
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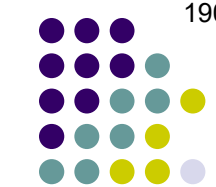
Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

How long is the SOF?
About 2 cm

Is CN3 a single entity as it passes through the SOF?
No--by the time it reaches the SOF, CN3 has already split into [redacted] and [redacted] divisions

nulus itself?
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--**CN3**
--CN6

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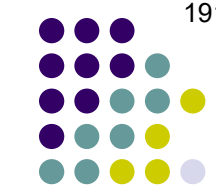
What portion of the SOF is straddled by the annulus?
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ◄——————————————————► *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
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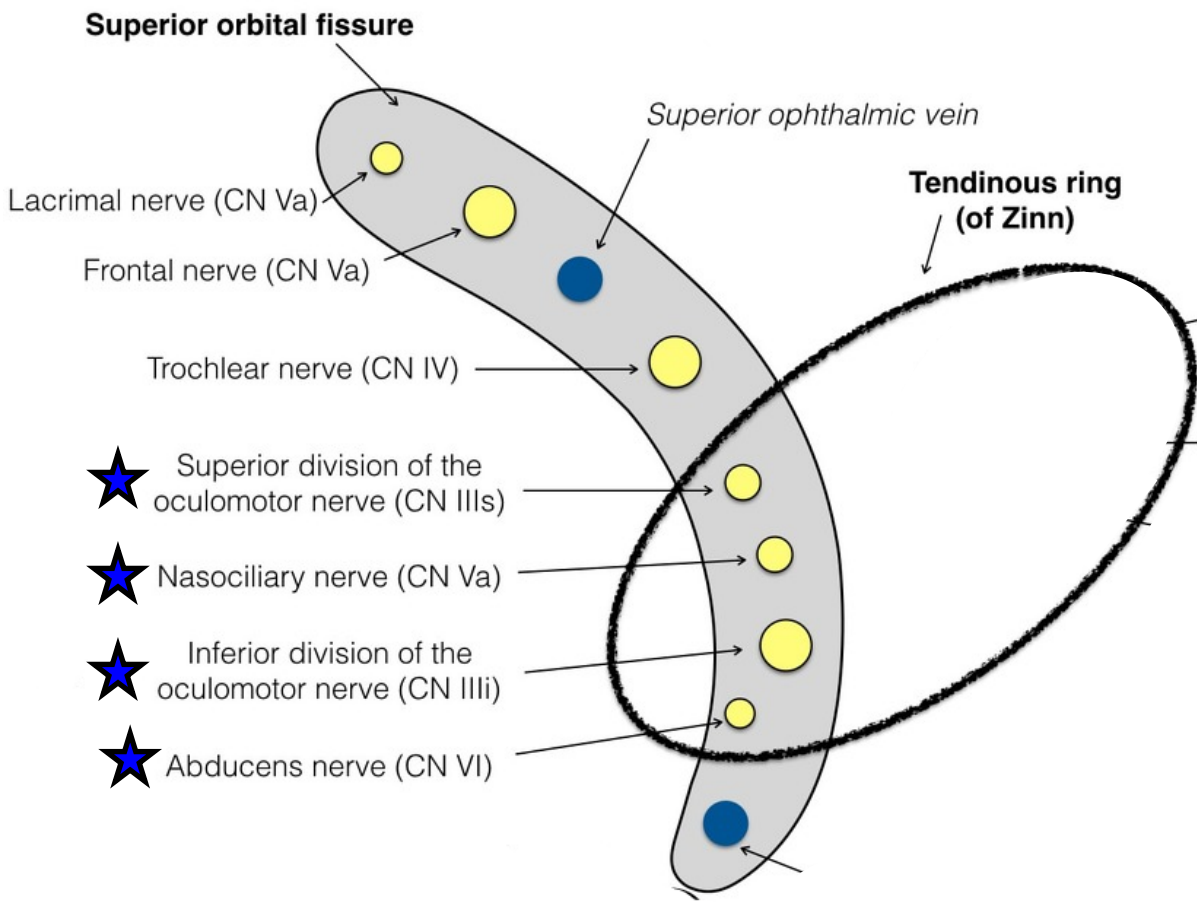
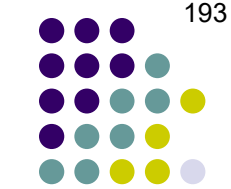
What portion of the SOF is straddled by the annulus?
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Superior orbital fissure: Intra-annular portion

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

How long is the SOF?

Which muscles are innervated by fibers in the:
Superior division?
Inferior division?

No--by the time it reaches the SOF, CN3 has already split into **superior and inferior divisions**

wh *nulus itself?*
The annulus
--The nasociliary nerve
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What are they called?
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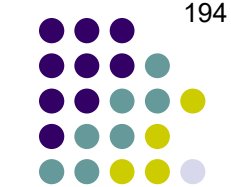
What portion of the SOF is straddled by the annulus?
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

How long is the SOF?

Which muscles are innervated by fibers in the:
Superior division? Superior rectus, and the levator
Inferior division?

No--by the time it reaches the SOF, CN3 has already split into **superior and inferior divisions**

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--**CN3**
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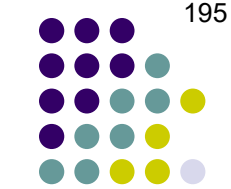
Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

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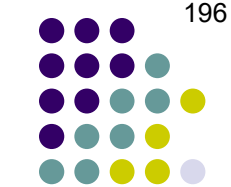
Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

How long is the SOF?

Which muscles are innervated by fibers in the:
Superior division? Superior rectus, and the levator
Inferior division? The medial rectus, inferior rectus and inferior oblique

No--by the time it reaches the SOF, CN3 has already split into **superior and inferior divisions**

wh *nulus itself?*
The annulus
--The nasociliary nerve
--**CN3**
--CN6

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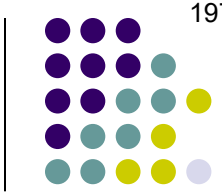
Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ◄——————————————————► *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

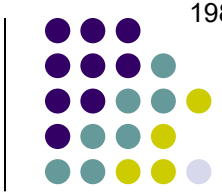
How long is the SOF?
About 2 cm

The SOF is straddled by a very important structure--what is the eponymous name of this structure?
The annulus of Zinn

By dint of its location, the annulus divides the SOF into three sections. What are they called?
--The **superior** portion is above the annulus
--The **intra-annular** portio
--The **inferior** portion belo
Roughly the middle third

What structures pass through the inferior portion?

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ◄——————————————————► *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

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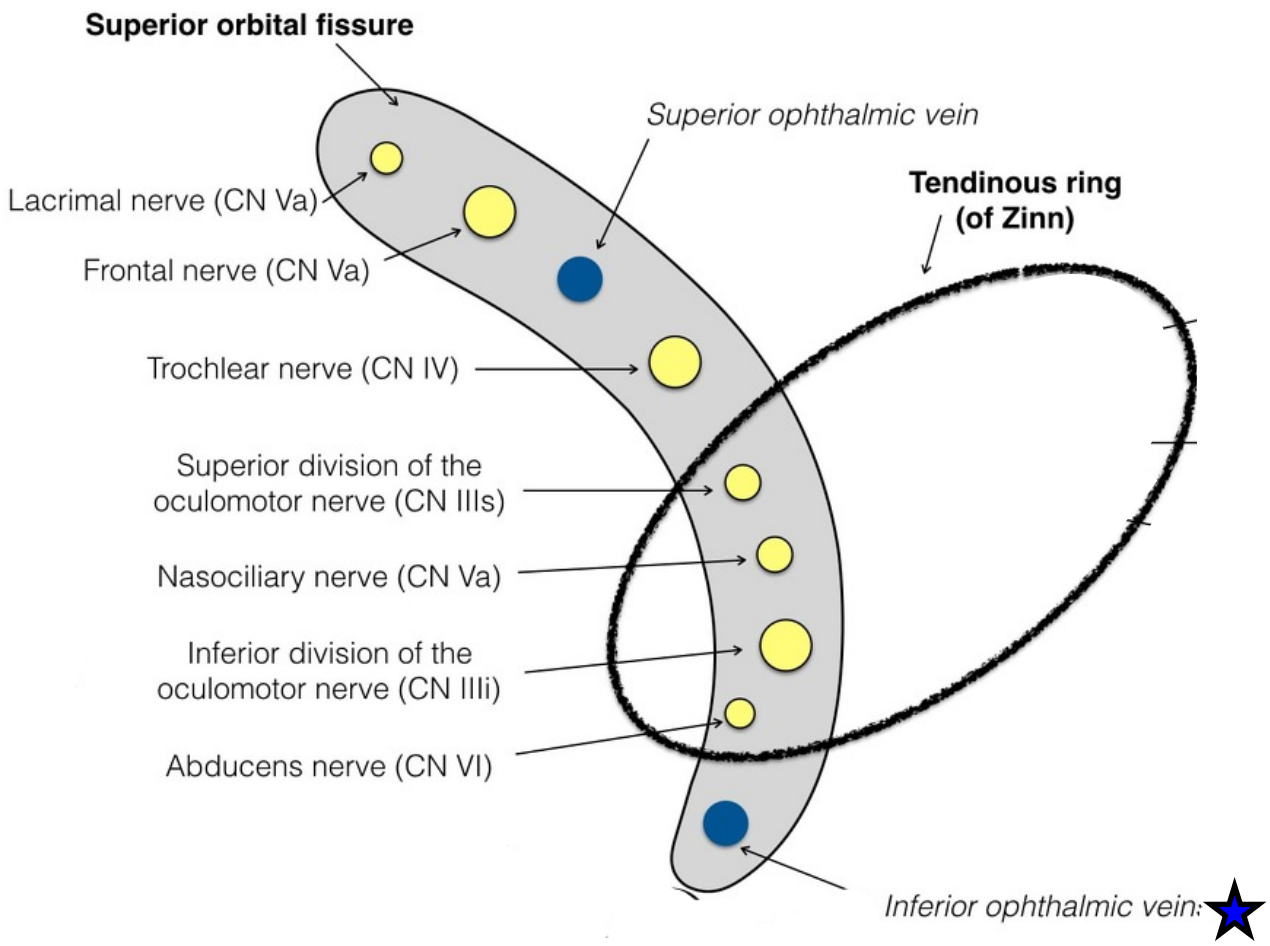
--The **superior** portion is above the annulus
--The **intra-annular** portio
--The **inferior** portion belo
Roughly the middle third

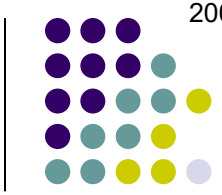
What structures pass through the inferior portion?
Not much. Sometimes, the inferior ophthalmic vein passes through it.

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Superior orbital fissure: Inferior portion

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

How long is the SOF?
About 2 cm

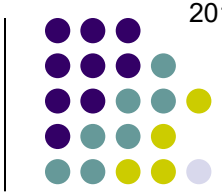
The SOF is straddled by a very important structure-- what is the eponymous name of this structure?
The annulus of Zinn

By the way: Are the terms 'inferior portion of the SOF' and 'inferior orbital fissure' synonyms?

--The **intra-annular** portion
--The **inferior** portion below it

What portion of the SOF is straddled by the annulus?
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

How long is the SOF?
About 2 cm

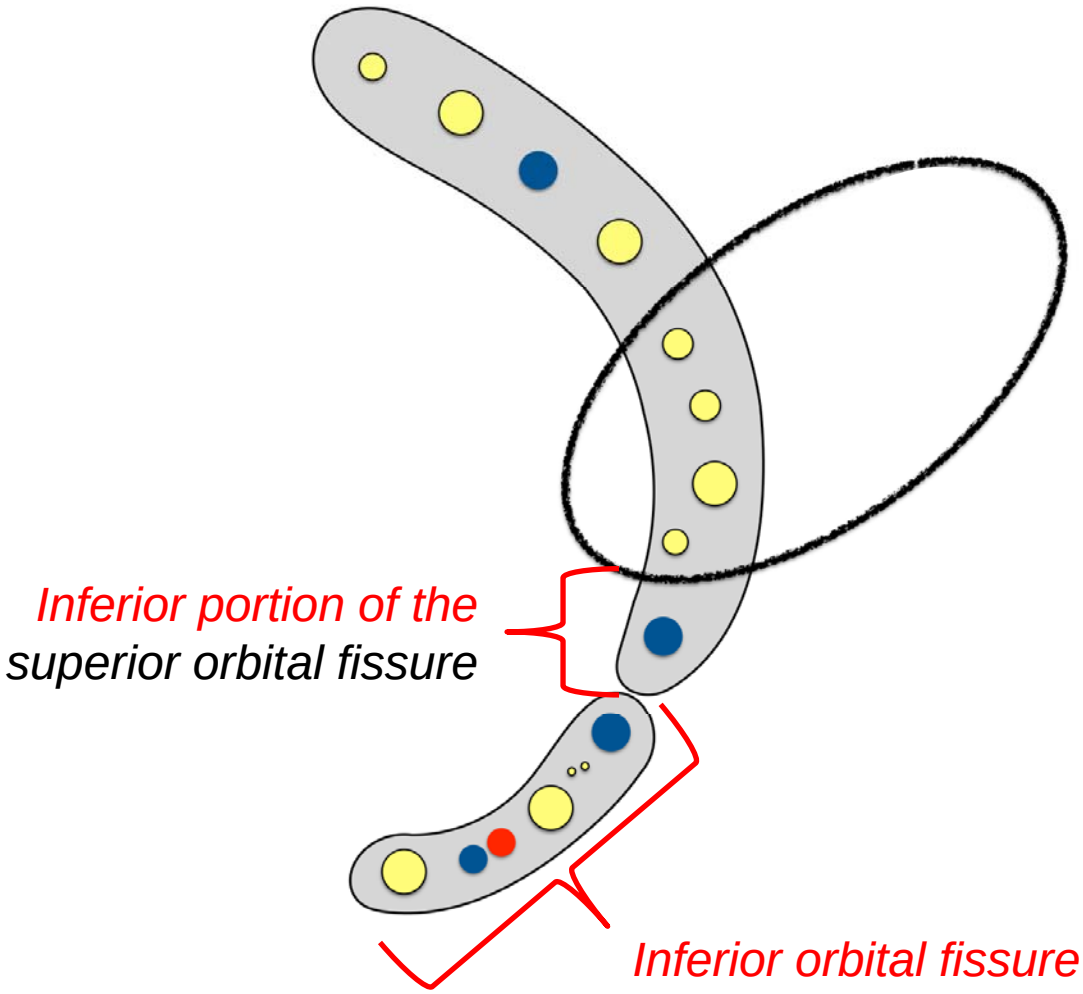
The SOF is straddled by a very important structure-- what is the eponymous name of this structure?
The annulus of Zinn

By the way: Are the terms 'inferior portion of the SOF' and 'inferior orbital fissure' synonyms?
No! The inferior orbital fissure is a separate and distinct structure from the inferior portion of the SOF. Don't get them confused!

--The **intra-annular** portion
--The **inferior** portion below it

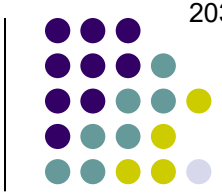
What portion of the SOF is straddled by the annulus?
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Inferior portion of the superior orbital fissure
vs the inferior orbital fissure

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ◄——————————————————► *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

How l
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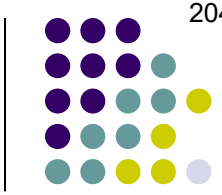
What bony relationship forms the inferior orbital fissure?

By the way. Are the terms 'inferior
ms?
No! **The inferior orbital fissure** s
ion
of the SOF. Don't get them confuse

--The **intra-annular** portion
--The **inferior** portion below it

What portion of the SOF is straddled by the annulus?
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ◄——————————————————► *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

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About

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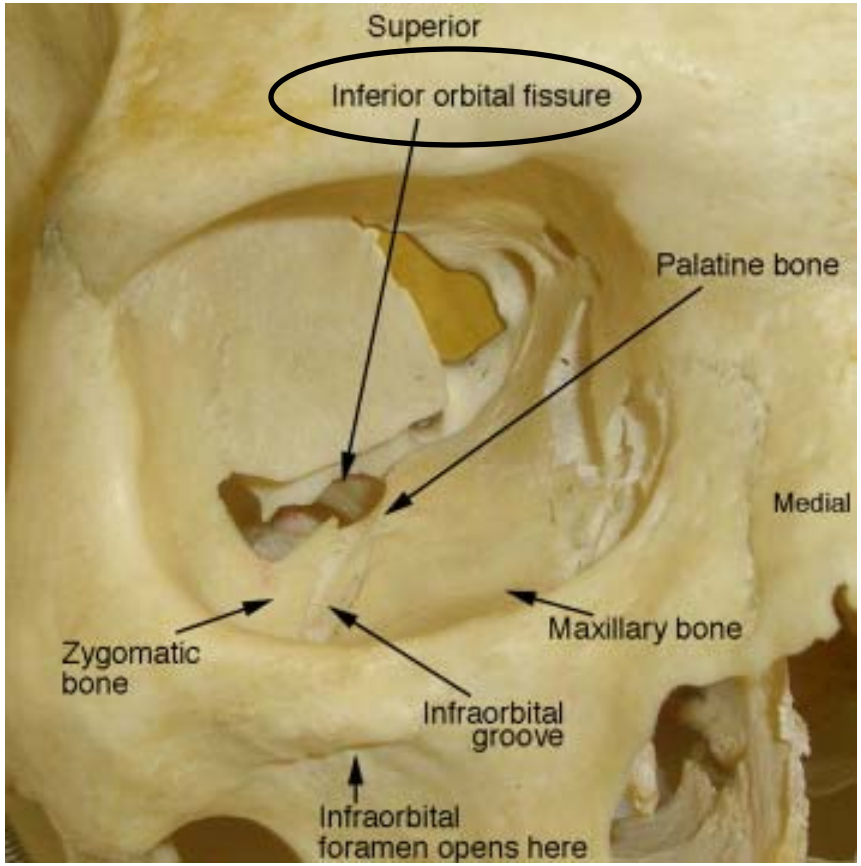
What bony relationship forms the inferior orbital fissure?
It is formed by a gap in the confluence among the orbital bones comprising the floor and medial wall

By the way. Are the terms 'inferior
ms?
No! **The inferior orbital fissure** s
ion
of the SOF. Don't get them confuse

--The **intra-annular** portion
--The **inferior** portion below it

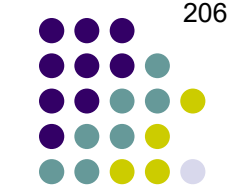
What portion of the SOF is straddled by the annulus?
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Inferior orbital fissure

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

How l
About

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The a

What bony relationship forms the inferior orbital fissure?
It is formed by a gap in the confluence among the orbital bones comprising the floor and medial wall

What structures pass through the inferior orbital fissure?
--
--
--

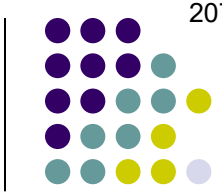
--

By the way. Are the terms 'inferior *ms?*
No! **The inferior orbital fissure** s *ion*
of the SOF. Don't get them confuse

--The **intra-annular** portion
--The **inferior** portion below it

What portion of the SOF is straddled by the annulus?
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus — **Superior orbital fissure** — Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

How l
About

The S
what
The a

What bony relationship forms the inferior orbital fissure?
It is formed by a gap in the confluence among the orbital bones comprising the floor and medial wall

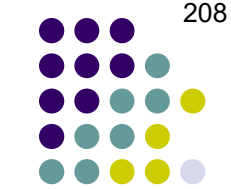
What structures pass through the inferior orbital fissure?
--The infraorbital nerve and artery
--The zygomatic nerve and artery
--Postganglionic parasympathetics heading up from the ganglion to the lacrimal gland
--The inferior ophthalmic vein (sometimes)

By the way. Are the terms 'inferior
ms?
No! **The inferior orbital fissure** is
ion
of the SOF. Don't get them confuse

--The **intra-annular** portion
--The **inferior** portion below it

What portion of the SOF is straddled by the annulus?
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of the sphenoid bone

How l
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what
The a

What bony relationship forms the inferior orbital fissure?
It is formed by a gap in the confluence among the orbital bones comprising the floor and medial wall

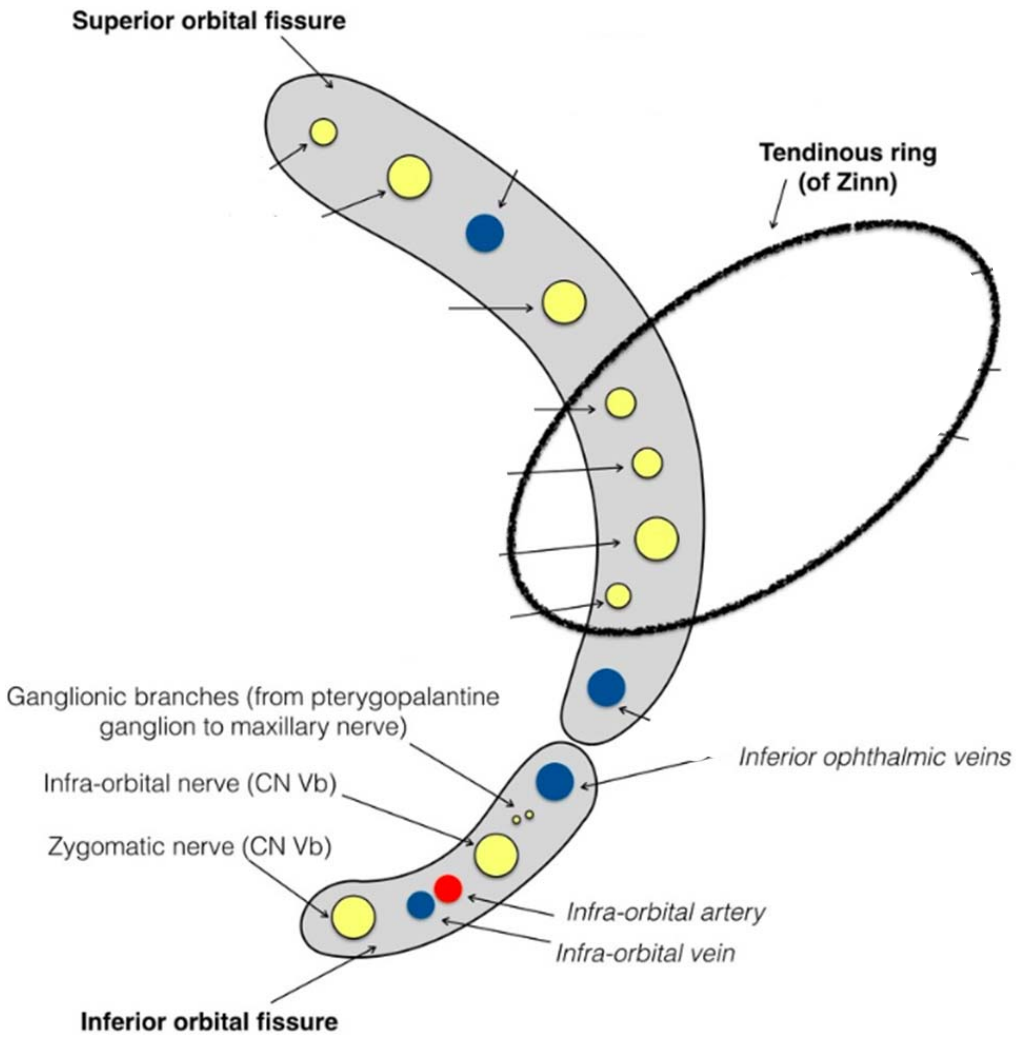
What structures pass through the inferior orbital fissure?
--The infraorbital nerve and artery
--The zygomatic nerve and artery
--Postganglionic parasympathetics heading up from the pterygopalatine ganglion to the lacrimal gland
--The inferior ophthalmic vein (sometimes)

By the way. Are the terms 'inferior
ms?
No! **The inferior orbital fissure** is
ion
of the SOF. Don't get them confuse

--The **intra-annular** portion
--The **inferior** portion below it

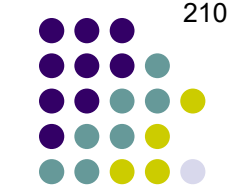
What portion of the SOF is straddled by the annulus?
Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Inferior orbital fissure and its associated structures

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of

What sort (ie, sensory, motor, autonomic, etc) of nerves are the infraorbital and zygomatic?

What structures pass through the inferior orbital fissure?
--The **infraorbital nerve** and artery
--The **zygomatic nerve** and artery
--Postganglionic parasympathetics heading up from the pterygopalatine ganglion to the lacrimal gland
--The inferior ophthalmic vein (sometimes)

By the way. Are the terms 'inferior
No! **The inferior orbital fissure**
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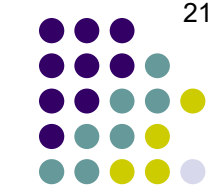
--The **intra-annular** portion
--The **inferior** portion below it

Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of

What sort (ie, sensory, motor, autonomic, etc) of nerves are the infraorbital and zygomatic?
Sensory

What structures pass through the inferior orbital fissure?
--The **infraorbital nerve** and artery
--The **zygomatic nerve** and artery
--Postganglionic parasympathetics heading up from the pterygopalatine ganglion to the lacrimal gland
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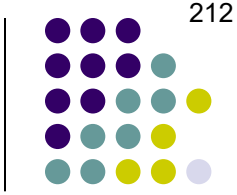
--The **inferior** portion below it

Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of

What sort (ie, sensory, motor, autonomic, etc) of nerves are the infraorbital and zygomatic?
Sensory

To which cranial nerve do they belong?

What structures pass through the inferior orbital fissure?
--The **infraorbital nerve** and artery
--The **zygomatic nerve** and artery
--Postganglionic parasympathetics heading up from the pterygopalatine ganglion to the lacrimal gland
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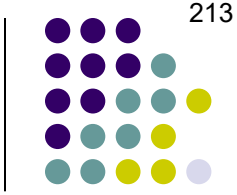
--The **inferior** portion below it

Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of

What sort (ie, sensory, motor, autonomic, etc) of nerves are the infraorbital and zygomatic?
Sensory

To which cranial nerve do they belong?
CN5 , specifically V# (aka the nerve)

What structures pass through the inferior orbital fissure?
--The **infraorbital nerve** and artery
--The **zygomatic nerve** and artery
--Postganglionic parasympathetics heading up from the pterygopalatine ganglion to the lacrimal gland
--The inferior ophthalmic vein (sometimes)

By the way. Are the terms 'inferior
No! **The inferior orbital fissure**
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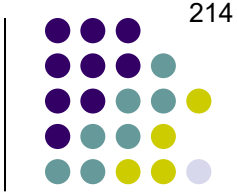
--The **intra-annular** portion
--The **inferior** portion below it

Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

What bony relationship forms the SOF?
It is the gap between the greater and lesser wings of

What sort (ie, sensory, motor, autonomic, etc) of nerves are the infraorbital and zygomatic?
Sensory

To which cranial nerve do they belong?
CN5 , specifically V2 (aka the maxillary nerve)

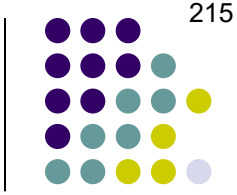
What structures pass through the inferior orbital fissure?
--The **infraorbital nerve** and artery
--The **zygomatic nerve** and artery
--Postganglionic parasympathetics heading up from the pterygopalatine ganglion to the lacrimal gland
--The inferior ophthalmic vein (sometimes)

By the way. Are the terms 'inferior
No! **The inferior orbital fissure**
of the SOF. Don't get them confuse

--The **intra-annular** portion
--The **inferior** portion below it

Roughly the middle third

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

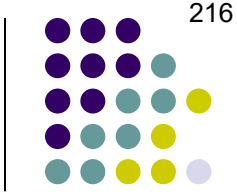
As stated earlier in the slide-set, this is how CS pathology presents clinically. How does SOF pathology present?

--CN6
--CN3
--CN4
--V1
--V2
--Postganglionic sympathetics:

--Engorged ocular surface veins
--Increased IOP
--Chemosis

Simultaneous deficits involving structures innervated by some (or all) of these nerves is highly suggestive of **CS pathology** especially if signs and symptoms of orbital congestion are present as well!

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

As stated earlier in the slide-set, this is how CS pathology presents clinically. How does SOF pathology present?
In the exact same manner

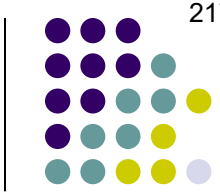
--CN6
--CN3
--CN4
--V1
--V2
--Postganglionic sympathetics:

Simultaneous deficits involving structures innervated by some (or all) of these nerves is highly suggestive of **CS pathology** *and SOF pathology* especially if

--Engorged ocular surface veins
--Increased IOP
--Chemosis

signs and symptoms of orbital congestion are present as well!

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus **Superior orbital fissure** Orbital apex

As stated earlier in the slide-set, this is how CS pathology presents clinically. How does SOF pathology present?

In the exact same manner

If CS pathology and SOF pathology present in identical fashion, how does one distinguish between them clinically?

--CN6
--CN3
--CN4
--V1
--V2
--Postganglionic sympathetics:

Simultaneous deficits involving

highly suggestive of

CS pathology *and SOF pathology*

especially

if

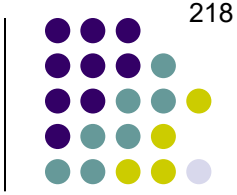
signs and symptoms

of orbital congestion are

present as well!

--Engorged ocular surface veins
--Increased IOP
--Chemosis

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus — **Superior orbital fissure** — Orbital apex

As stated earlier in the slide-set, this is how CS pathology presents clinically. How does SOF pathology present?

In the exact same manner

--CN6
--CN3
--CN4
--V1
--V2
--Postganglionic sympathetics:

If CS pathology and SOF pathology present in identical fashion, how does one distinguish between them clinically?
One doesn't--they cannot be reliably differentiated clinically. Further, given that the CS and SOF are contiguous, it is not uncommon for a pathologic process to involve both simultaneously.

Simultaneous deficits involving

highly suggestive of

CS pathology *and SOF pathology*

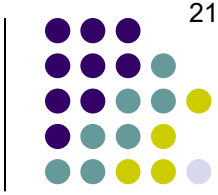
especially

if

signs and symptoms of orbital congestion are present as well!

--Engorged ocular surface veins
--Increased IOP
--Chemosis

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

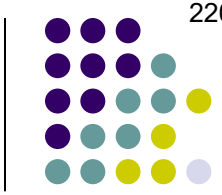
Cavernous sinus Superior orbital fissure **Orbital apex**

What critical structure is present at the orbital apex (OA) that wasn't present at the SOF or in the CS?

--CN6
--CN3
--CN4
--V1
--V2
--Postganglionic sympathetics
--***?***

--Engorged ocular surface veins
--Increased IOP
--Chemosis

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

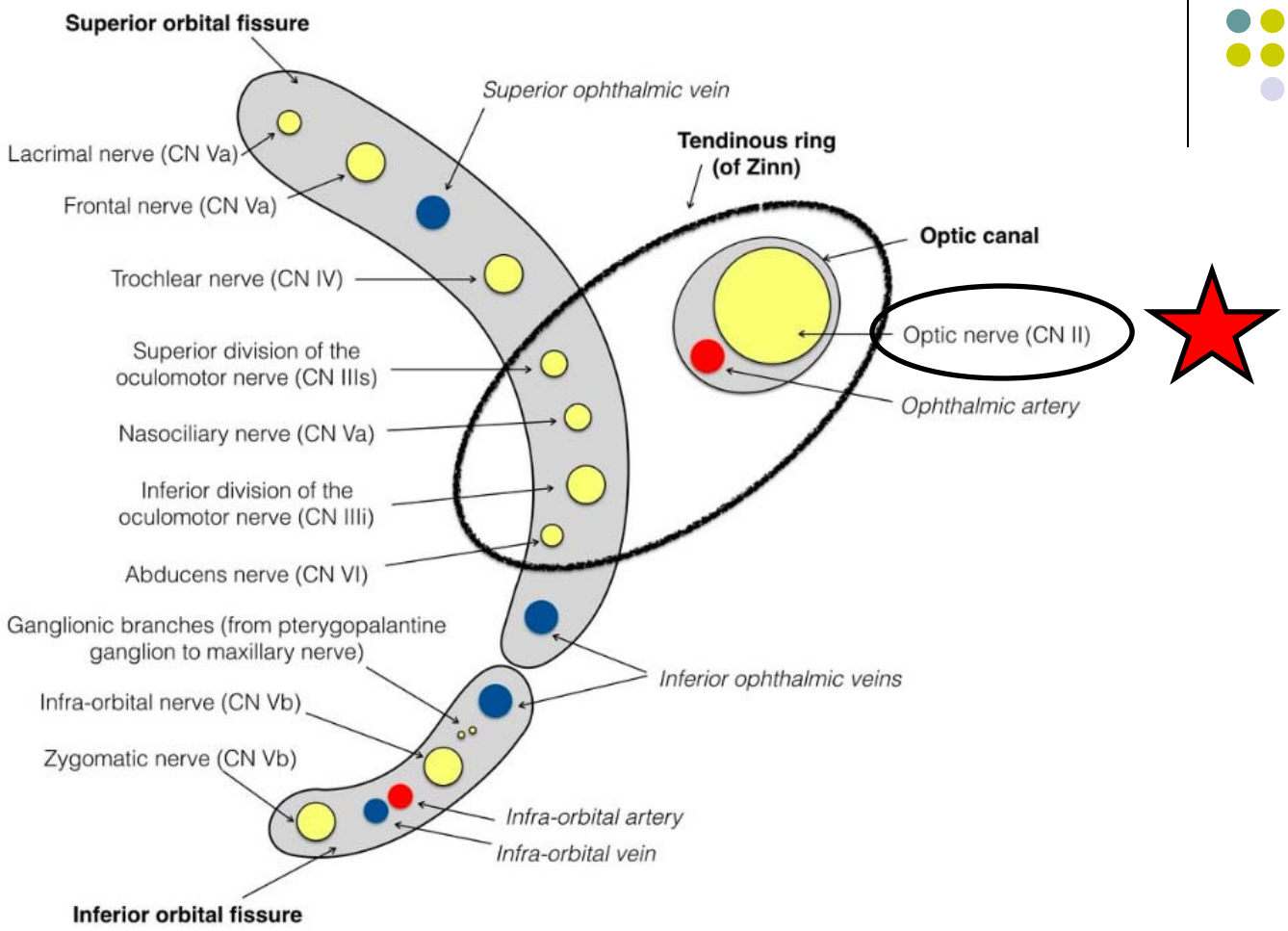
Cavernous sinus Superior orbital fissure **Orbital apex**

What critical structure is present at the orbital apex (OA) that wasn't present at the SOF or in the CS?
The optic nerve

--CN6
--CN3
--CN4
--V1
--V2
--Postganglionic sympathetics:
--**The optic nerve**

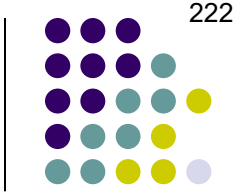
--Engorged ocular surface veins
--Increased IOP
--Chemosis

Motility Disorders: *The Sinus, the Fissure, and the Apex*



The orbital apex. Note the optic nerve has joined the party

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus | Superior orbital fissure | **Orbital apex**

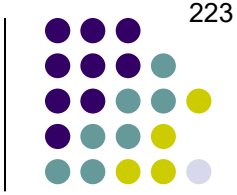
What critical structure is present at the orbital apex (OA) that wasn't present at the SOF or in the CS?
The optic nerve

What does the presence of the optic nerve indicate about the clinical presentation of pathology at the OA?

--CN6
--CN3
--CN4
--V1
--V2
--Postganglionic sympathetics:
--**The optic nerve**

--Engorged ocular surface veins
--Increased IOP
--Chemosis

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus | Superior orbital fissure | **Orbital apex**

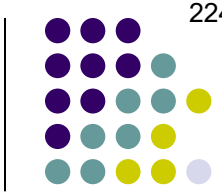
What critical structure is present at the orbital apex (OA) that wasn't present at the SOF or in the CS?
The optic nerve

What does the presence of the optic nerve indicate about the clinical presentation of pathology at the OA?
It indicates that vision could be affected

--CN6
--CN3
--CN4
--V1
--V2
--Postganglionic sympathetics
--**The optic nerve**

--Engorged ocular surface veins
--Increased IOP
--Chemosis

Motility Disorders: *The Sinus, the Fissure, and the Apex*



Posterior ⟵ ⟶ *Anterior*

Cavernous sinus — Superior orbital fissure — **Orbital apex**

--CN6
--CN3
--CN4
--V1
--V2
--Postganglionic sympathetics:
--The optic nerve

--Engorged ocular surface veins
--Increased IOP
--Chemosis

Simultaneous deficits involving structures innervated by some (or all) of these nerves, **along with the optic nerve,** is highly suggestive of **orbital apex pathology** especially if signs and symptoms of orbital congestion are present as well!