Supranuclear

Nuclear

Infranuclear

Fascicular
Subarachnoid
Cavernous sinus
Orbital
Neuromuscular junction
Extraocular muscle

MLF

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.
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

Supranuclear

Nuclear

Internuclear

Infranuclear

CN3 Nucleus

MLF

CN6 Nucleus

CN4 Nucleus

What is the hallmark of pathology involving these three locations?

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

Optic nerve

CN3

CN4

V1 and V2

CN6

Postganglionic sympathetics

Orbital

Superior orbital fissure

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

**Supranuclear**

**Nuclear**

**Infranuclear**

Fascicular

Subarachnoid

**Cavernous sinus**

Superior orbital fissure

Orbital apex

Neuromuscular junction

Extraocular muscle

---

**What is the hallmark of pathology involving these three locations?**

Deficits implicating multiple nerves simultaneously
Motility Disorders: The Sinus, the Fissure, and the Apex

Supranuclear

Nuclear

Internuclear

Infranuclear

Fascicular

Subarachnoid

Cavernous sinus

Superior orbital fissure

Orbital apex

Neuromuscular junction

Extraocular muscle

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**

**Nuclear**

**Infranuclear**

Fascicular

Subarachnoid

Cavernous sinus
Superior orbital fissure
Orbital apex

Neuromuscular junction
Extraocular muscle

MLF

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

Supranuclear

Nuclear

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Cavernous sinus
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Extraocular muscle

MLF

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

Supranuclear

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Infranuclear

Fascicular
Subarachnoid
Cavernous sinus
Superior orbital fissure
Orbital apex
Neuromuscular junction
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

MLF

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.
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*

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

Cavernous sinus Superior orbital fissure Orbital apex

How many CSs are in a standard human head?
How many CSs are in a standard human head?
Two
How many CSs are in a standard human head?
Two

Where are they located?
Motility Disorders: The Sinus, the Fissure, and the Apex

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

Cavernous sinuses
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

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?
The pituitary gland, duh
Motility Disorders: *The Sinus, the Fissure, and the Apex*

Cavernous sinus | Superior orbital fissure | Orbital apex

Posterior ← — Anterior

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?
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

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?
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 ← Cavernous sinus Superior orbital fissure Orbital apex → Anterior

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

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

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

The latter, as it explains how some pathologic processes can spread from one CS to the other.
Motility Disorders: The Sinus, the Fissure, and the 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?
Venous sinus

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

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?
Venous sinus
One of a number responsible for draining the cranial vault

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?
The latter, as it explains how some pathologic processes can spread from one CS to the other
Motility Disorders: *The Sinus, the Fissure, and the Apex*

**Cavernous sinus**  Superior orbital fissure  Orbital apex

*Posterior*  *Anterior*

**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

**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?**

- The latter, as it explains how pathologic processes can spread from one CS to the other
Motility Disorders: The Sinus, the Fissure, and the Apex

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

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 ← Cavernous sinus Superior orbital fissure Orbital apex Anterior

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

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

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

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

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

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

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

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*

**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

--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

**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

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

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

<table>
<thead>
<tr>
<th>Posterior</th>
<th>Cavernous sinus</th>
<th>Superior orbital fissure</th>
<th>Orbital apex</th>
<th>Anterior</th>
</tr>
</thead>
</table>

**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

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

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

<table>
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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

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

Superior ophthalmic vein

Inferior ophthalmic vein

Circular venous plexus

Cavernous sinus

Superior petrosal sinus

Basilar plexus

Inferior petrosal sinus

Internal jugular vein

Inferior petrosal sinus and the CS
Motility Disorders: The Sinus, the Fissure, and the Apex

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

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 ← Cavernous sinus ← Superior orbital fissure ← Orbital apex → Anterior

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

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
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

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

Which cranial nerve travels in Dorello’s canal on its way to the CS?
Motility Disorders: The Sinus, the Fissure, and the Apex

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

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

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

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

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

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
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

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

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.

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

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

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?
Cavernous sinus

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

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?
The eye and orbit (along with some intracranial blood)
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

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?
The eye and orbit (along with some intracranial blood)
Motility Disorders: The Sinus, the Fissure, and the 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

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?
The eye and orbit (along with some intracranial blood)

What vessel is the main conduit for blood leaving the eye to get to the CS?
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*

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

--The internal carotid artery
--CN6
--CN3
--CN4
--V1
--V2
--Postganglionic sympathetics
**Motility Disorders: The Sinus, the Fissure, and the Apex**

### Cavernous sinus

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

- The internal carotid artery
- CN6
- CN3
- CN4
- V1
- V2
- Postganglionic sympathetics

--- *Not the...*

*What eye-critical structure is notable for its absence from this list?*
Motility Disorders: The Sinus, the Fissure, and the Apex

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?

--The internal carotid artery
--CN6
--CN3
--CN4
--V1
--V2
--Postganglionic sympathetics

Not the...optic nerves!

What eye-critical structure is notable for its absence from this list?
The optic nerve
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 artery: ?
--- CN6: ?
--- CN3: ?
--- CN4: ?
--- V1: ?
--- V2: ?
--- Postganglionic sympathetics: ?
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 artery: The cavern
--CN6: The cavern
--CN3: The lateral wall
--CN4: The lateral wall
--V1: The lateral wall
--V2: The lateral wall
--Postganglionic sympathetics: The cavern
Motility Disorders: The Sinus, the Fissure, and the Apex

Cavernous sinus, and related structures
(Not pictured: postganglionic sympathetics)
Motility Disorders: The Sinus, the Fissure, and the 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 artery: The cavern
--CN6: The cavern
--CN3: The lateral wall
--CN4: The lateral wall
--V1: The lateral wall
--V2: The lateral wall
--Postganglionic sympathetics: Simultaneous deficits involving structures innervated by some (or all) of these nerves is highly suggestive of CS pathology
Motility Disorders: The Sinus, the Fissure, and the Apex

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 artery: The cavern  
--CN6: The cavern  
--CN3: The lateral wall  
--CN4: The lateral wall  
--V1: The lateral wall  
--V2: The lateral wall  
--Postganglionic sympathetics

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

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

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

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 artery: The cavern
--CN6: The cavern
--CN3: The lateral wall
--CN4: The lateral wall
--V1: The lateral wall
--V2: The lateral wall
--Postganglionic sympathetics: Simultaneous deficits involving structures innervated by some (or all) of these nerves is highly suggestive of CS pathology

What other signs/symptoms of CS disease might be present?
--Engorged ocular surface veins
--Increased IOP
--Chemosis
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 artery: The cavern
- CN6: The cavern
- CN3: The lateral wall
- CN4: The lateral wall
- V1: The lateral wall
- V2: The lateral wall
- Postganglionic sympathetics:

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!

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

- Engorged ocular surface veins
- Increased IOP
- Chemosis
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

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 artery: The cavern
--CN6: The cavern
--CN3: The lateral wall
--CN4: The lateral wall
--V1: The lateral wall
--V2: The lateral wall
--Postganglionic sympathetics

Simultaneous deficits involving structures innervated by some (or all) of these nerves is highly suggestive of CS pathology, as if signs and symptoms of CS disease might be present.

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

- Engorged ocular surface veins
- Increased IOP
- Chemosis

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

Increased IOP
Chemosis
Engorged ocular surface veins

Simultaneous deficits involving structures innervated by some (or all) of these nerves is highly suggestive of CS pathology, as if signs and symptoms of orbital congestion are present as well!
Motility Disorders: The Sinus, the Fissure, and the Apex

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 artery: The cavern
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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.
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- Postganglionic sympathetics:  

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Three general categories of CS pathology:
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What other signs/symptoms of CS disease might be present?
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Three general categories of CS pathology:

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

Posterior ← Cavernous sinus Superior orbital fissure Orbital apex Anterior

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?
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--V1: The lateral wall
--V2: The lateral wall
--Postganglionic sympathetics: Posterior

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

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Cavernous sinus

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--Postganglionic sympathetics:

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Two broad types of CS vascular pathology:

Neoplastic

Vascular

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

Posterior

Cavernous sinus Superior orbital fissure Orbital apex

Anterior

Neoplastic

Vascular

Thrombosis

Fistula

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- Increased IOP
- Chemosis

Neoplastic

Vascular
- Thrombosis
- Fistula

Inflammatory

Two types of CS thrombosis:
- Septic
- Aseptic
In septic CS thrombosis, is the intra-cavernous infection usually primary to the sinus, or does it originate in another site?

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

--Engorged ocular surface veins
--Increased IOP
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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

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

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

Neoplastic

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Vascular

Thrombosis

Fistula

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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.

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

- ?
- ?
- ?

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

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

- The mid-face
- The oral cavity (usually in the form of a dental infection)
- The sphenoid/ethmoid sinuses

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.

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

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In inflammatory CS disease, all three main compartments (neoplastic, vascular, and inflammatory) can be affected.

- Neoplastic
- Vascular
- Inflammatory

Septic

Thrombosis

Fistula

Aseptic

Fistula
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.

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Neoplastic
Vascular
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Septic
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What about orbital cellulitis—can it be the nidus for CS thrombosis?

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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Neoplastic
- Thrombosis
- Fistula

Vascular
- Septic
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Motility Disorders: The Sinus, the Fissure, and the Apex

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Neoplastic

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

Aseptic

Neoplastic

Septic

Vascular

Neoplasic

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The typical case presents unilaterally, but quickly becomes bilateral if appropriate and aggressive tx isn’t initiated. In the proper clinical context (ie, a very ill pt), bilateral simultaneous ophthalmic neuropathies is essentially diagnostic of septic CS thrombosis.

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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*

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**Cavernous Sinus:**

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--- Chemosis

What about aseptic CS thrombosis—how does it present?

It presents in similar fashion to the septic variety, except:

--- the pt is not nearly as ill-appearing;
--- the signs/symptoms of orbital congestion are not as severe.

Further, and not surprisingly, lab work fails to reveal evidence of an infection.

How is it managed?

With anticoagulation/anti-platelet therapy

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

Posterior ← Superior orbital fissure → Orbital apex
Cavernous sinus

Neoplastic
Vascular
Fistula
Thrombosis
Inflammatory

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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

**Cavernous sinus**

- Superior orbital fissure
- Orbital apex

---

**Diagram:**

- Neoplastic
- Vascular
  - Thrombosis
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Superior orbital fissure

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Neoplastic
Vascular
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Septic
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Two types of CS fistula:

Neoplastic
Vascular
Inflammatory
Septic
Aseptic
Thrombosis
Fistula
?
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 artery: The cavern
--CN6: The cavern
--CN3: The lateral wall
--CN4: The lateral wall
--V1: The lateral wall
--V2: The lateral wall
--Postganglionic sympathetics:

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

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

Cavernous sinus Superior orbital fissure Orbital apex

Posterior Anterior

Neoplastic

Vascular

Fistula

Thrombosis

Septic Aseptic

High-flow

Low-flow

Inflammatory

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

- Engorged ocular surface veins
- Increased IOP
- Chemosis

What are the others? Where within the CS is each located?

- The internal carotid artery: The cavern
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Motility Disorders: The Sinus, the Fissure, and the Apex

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

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

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

- Engorged ocular surface veins
- Increased IOP
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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 branches) wholly within the confines of a venous structure (ie, the CS itself).

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

Neoplastic
Vascular
Fistula
Inflammatory

Thrombosis
High-flow
Low-flow
Septic
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An aspect of CS anatomy makes it uniquely vulnerable to the development of A-V fistulas. What is that aspect?
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What is the fundamental problem that results from a fistula within the CS?

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--Increased IOP
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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
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Motility Disorders: The Sinus, the Fissure, and the Apex
An aspect of CS anatomy makes it uniquely vulnerable to the development of A-V fistulas. Earlier in the slide-set, the main venous conduit from the eye and orbit to the CS was identified. What was it again?

It’s the superior ophthalmic vein. It’s a conduit that drains 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**

Neoplastic

Vascular

--Fistula

Inflammatory

Septic

Aseptic

Thrombosis

High-flow

Low-flow
Motility Disorders: The Sinus, the Fissure, and the Apex

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

It’s important to note that this conduit connects the eye with 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
An aspect of CS anatomy makes it uniquely vulnerable to the development of A-V fistulas. 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’s 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
An aspect of CS anatomy makes it uniquely vulnerable to the development of A-V fistulas.

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!

Inflammatory

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

Neoplastic

Vascular

Fistula

Thrombosis

High-flow

Septic

Aseptic

Low-flow

Inflammatory
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.
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. 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—what 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
--Increased IOP
--Chemosis

Motility Disorders: The Sinus, the Fissure, and the Apex
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? It's a pressure thing. A fistula allows high-pressure blood from the arterial tree to flow into the low-pressure, venous-sided CS. This impedes venous flow into the CS, leading to congestion of the eye and orbit.

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
--Increased IOP
--Chemosis

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

The classic term used to describe the appearance of these arterialized conj vessels is 'corkscrewing'.

Motility Disorders: The Sinus, the Fissure, and the Apex
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? It’s a pressure thing. A fistula allows high-pressure blood from the arterial tree to flow into the low-pressure, venous-sided CS. This impedes venous flow into the CS. 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.

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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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 artery: The cavern
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- Postganglionic sympathetics:

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

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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?

It's a pressure thing. A fistula allows blood from the high-pressure, arterial side to flow into the low-pressure, venous-sided CS, which impedes venous flow into the CS. 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 is the classic term used to describe the appearance of these arterialized conj vessels?

'Arterialization of conj vessels'

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

Arterialization of conj vessels

Motility Disorders: The Sinus, the Fissure, and the Apex
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? 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 pressure increase within the CS impedes venous flow into the CS, leading to congestion of the eye and orbit. 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 --Increased IOP --Chemosis

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’
Corkscrewing of conj vessels 2ndry to CCF
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?

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

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

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…

CS pathology

Neoplastic

Vascular

Thrombosis

Inflammatory

Fistula

Septic

Aseptic

High-flow

Low-flow
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?

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- V1: The lateral wall
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- Postganglionic sympathetics:

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

- Engorged ocular surface veins
- Increased IOP
- Chemosis

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.

CS pathology

- Neoplastic
- Vascular
  - Fistula
    - High-flow
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- Thrombosis
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- Inflammatory
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?

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

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

What is the anatomic difference between low- and high-flow fistulas? What is the most common cause of high-flow fistulas?

- High-flow fistula
- low-flow fistula

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

--Severe head trauma

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

CS pathology

\[
\text{Neoplastic} \quad \text{Vascular} \quad \text{Inflammatory}
\]

\[
\text{Thrombosis} \quad \text{Fistula} \quad \text{High-flow} \quad \text{Low-flow}
\]

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

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

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

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

Severe head trauma

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

Severe head trauma

High-flow fistula vs. low-flow fistula:

A low-flow fistula involves a dural branch of the internal carotid, whereas a high-flow fistula involves the internal carotid itself.

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

High-flow fistula vs. low-flow fistula:

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

Severe head trauma

CS pathology:

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

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

Cavernous

Posterior

Anterior

Orbital apex

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

Neoplastic

Vascular

Fistula

Neoplastic

Thrombosis

Inflammatory

Septic

Aseptic

Fistula

Thrombosis

Low-flow

High-flow

low-flow fistula

high-flow fistula

How about low-flow fistulas—other than flow rate, duh?

Low-flow fistula involves...a dural branch of the internal carotid, whereas a high-flow fistula involves...the internal carotid itself.

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?

Older.

Inflammatory

Neoplastic

Vascular

Fistula

Thrombosis

Posterior

Anterior

Orbital apex

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--Engorged ocular surface veins
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--Chemosis

--Neoplastic
--Vascular
--Inflammatory

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.

CS pathology:

High-flow

Vascular

Fistula

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Septic

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

High-flow fistula
Involves...a dural branch of the internal carotid, whereas

low-flow fistula
Involves...the internal carotid itself

How about low-flow fistulas--are they secondary 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?
Older

Inflammatory

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

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CS pathology:

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

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low-flow fistula

Vascular

Fistula

High-flow

Low-flow

Neoplastic

Thrombosis

Aseptic

Septic

Inflammatory

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

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

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CS pathology

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There is a gender predilection?

Yes, ♀ are more likely to be affected

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

Posterior

Cavernous

Anterior

Orbital apex

How about low-flow fistulas—are they secondary 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?

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

CS pathology

Neoplastic

Vascular

Fistula

High-flow

Low-flow

Inflammatory

Septic

Aseptic

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.

How about low-flow fistulas—are they secondary to trauma as well?

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?

Older

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

**CS pathology**

- Neoplastic
- Vascular
  - Thrombosis
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    - High-flow
    - Low-flow
  - Septic
  - Aseptic
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Yes, ♀ are more likely to be affected

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Older

**low-flow fistula**

A low-flow fistula involves...a dural branch of the internal carotid, whereas

**high-flow fistula**

A high-flow fistula involves...the internal carotid itself

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

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

- Engorged ocular surface veins
- Increased IOP
- Chemosis

With respect to their clinical presentation, how do high- and low-flow fistulas differ?

What is the anatomic difference between low- and high-flow fistulas (other than flow rate, duh)?

- **Low-flow fistula** involves a dural branch of the internal carotid, whereas a **high-flow fistula** involves the internal carotid itself.

With respect to their clinical presentation, how do high- and low-flow fistulas differ?

- They don’t—at least, not in a manner reliable enough to be distinguish between them. That is, one cannot differentiate between low-flow fistulas on the basis of the extent of the neural deficits, or the severity of the congestion signs/symptoms.
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?

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With respect to their clinical presentation, how do high- and low-flow fistulas differ? They don’t—at least, not in a manner reliable enough to be distinguish between them.

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

- Engorged ocular surface veins
- Increased IOP
- Chemosis
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---V1: The lateral wall

---V2: The lateral wall

---Postganglionic sympathetics

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

---Engorged ocular surface veins

---Increased IOP

---Chemosis

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.

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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
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Is there any way to distinguish between the high- and low-flow versions in the clinic?

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.

With respect to their clinical presentation, how do high- and low-flow fistulas differ?
They don’t— at least, not in a manner reliable enough to be distinguish between them. That is, one cannot differentiate between high- and low-flow fistulas on the basis of the extent of the neural deficits, or the severity of the congestion signs/symptoms.

Is there any way to distinguish between the high- and low-flow versions in the clinic?

There’s one—the presence of a bruit, which signifies the fistula is high-flow.

Inflammatory

Vascular

Fistula

High-flow

Low-flow

Neoplastic

Thrombosis

Aseptic

Septic

CS pathology

Cavernous sinus Superior orbital fissure Orbital apex

Anterior

Posterior
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?

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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

Is there any way to distinguish between the high- and low-flow versions in the clinic?

There's one--the presence of a ___, which signifies the fistula is ___-flow.

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.

With respect to their clinical presentation, how do high- and low-flow fistulas differ?

They don't--at least, not in a manner reliable enough to be distinguish between them. That is, one cannot differentiate between high- and low-flow fistulas on the basis of the extent of the neural deficits, or the severity of the congestion signs/symptoms.

Is there any way to distinguish between the high- and low-flow versions in the clinic?

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The BCSC Neuro book discusses one specific inflammatory condition by name. What is that condition?

**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?

No

Is there a gender predilection?

No
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infectious vs non

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Is it common, or rare? Very rare

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Systemic steroids

How does Tolosa-Hunt respond to steroid tx?

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

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Map

Exquisitely responsive

The pain is [exquisitely responsive], whereas the ophthalmoplegia takes longer to resolve.

How does Tolosa-Hunt respond to steroid tx?

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Which two causes are particularly notorious for being steroid-responsive, and thus giving a false confirmation of Tolosa-Hunt?

- Neoplasm (Lymphoma)
- Infectious

Which neoplasm in particular?

Lymphoma

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

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.”

Which neoplasm in particular? Lymphoma

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Which type of infectious in particular?

- Fungal

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Is there a gender predilection?

- No

What is the treatment of choice for Tolosa-Hunt?

- Systemic steroids

How does Tolosa-Hunt respond to steroid tx?

- The pain is exquisitely responsive, whereas the ophthalmoplegia takes longer to resolve

The (well-deserved) reputation for being steroid-responsive enjoyed by Tolosa-Hunt can be highly misleading—why?

Because other, far more common causes of painful ophthalmoplegia are steroid-responsive too. So steroid-responsiveness should not be interpreted as confirming the diagnosis of Tolosa-Hunt.
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 artery: The cavern--
- CN3: The lateral wall
- CN4: The lateral wall
- V1: The lateral wall
- V2: The lateral wall
- Postganglionic sympathetics

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

- Engorged ocular surface veins
- Increased IOP
- Chemosis

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

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

What bony relationship forms the SOF?
Superior orbital fissure

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*

**Skull: Anterior View**
Right Orbit: Frontal and Slightly Lateral View

- Superior orbital fissure
- Greater wing of sphenoid
- Lesser wing of sphenoid
- Optic canal (foramen)
- Inferior orbital fissure

Superior orbital fissure
Motility Disorders: The Sinus, the Fissure, and the Apex

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

Superior orbital fissure

*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
Superior orbital fissure

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How long is the SOF?
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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**

Cavernous sinus   Superior orbital fissure   Orbital apex

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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

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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

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**Superior orbital fissure**

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Roughly the middle third.
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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Motility Disorders: *The Sinus, the Fissure, and the Apex*

- Superior orbital fissure
- Tendinous ring (of Zinn)
- Superior portion
- Intra-annular portion
- Inferior portion

Superior orbital fissure and the annulus of Zinn
Motility Disorders: The Sinus, the Fissure, and the Apex

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--The inferior portion is below it.

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

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

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

Superior orbital fissure: Superior portion

- Lacrimal nerve (CN Va)
- Frontal nerve (CN Va)
- Trochlear nerve (CN IV)
- Superior ophthalmic vein
- Tendinous ring (of Zinn)
**Motility Disorders: The Sinus, the Fissure, and the Apex**

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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 V1 (aka the ophthalmic nerve).
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--- The lacrimal and frontal nerves
--- CN4

What sort (i.e., 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)

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

Which of these passes through the inferior portion of the SOF?
--- CN4
Motility Disorders: The Sinus, the Fissure, and the Apex

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

To which cranial nerve do they belong?
--CN4
--CN5, specifically V1 (aka the ophthalmic nerve)

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

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

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--CN4

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--N asociliary
--F frontal
--L lacrimal

Note that the initials of the V1 branches make a good mnemonic!
Motility Disorders: The Sinus, the Fissure, and the Apex

Cavernous sinus
Superior orbital fissure
Orbital apex

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--The lacrimal and frontal nerves
--CN4

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

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

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


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

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

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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The frontal nerve…

By dint of its location, the lacrimal and frontal nerves are straddled by the annulus.

What are they called?
--The superior portion
--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

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.

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

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

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 structures pass through the superior portion of the SOF? The superior ophthalmic vein and the lacrimal and frontal nerves (CN4).

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

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

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The lacrimal nerve...heads toward, and is sensory to, the lacrimal gland
The frontal nerve...divides into two terminal branches (the [ ] and [ ] nerves), which are sensory to the forehead, upper lids, and a portion of the conjunctiva.

To which cranial nerve do they belong?
The lacrimal nerve belongs to CN5, specifically V1 (aka the ophthalmic nerve).

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

How many terminal branches does the frontal nerve divide into?
Two (the supraorbital and supratrochlear nerves).

What structures pass through the superior portion of the SOF?
The superior ophthalmic vein.

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

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

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

By dint of its location, the lacrimal and frontal nerves are straddled by the annulus:
--The superior portion is above the annulus
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--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

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

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 structures pass through the annulus itself?
- ?
- ?
- ?

Orbital apex

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

**Superior orbital fissure**

**Posterior** ← Cavernous sinus ← Superior orbital fissure ← Orbital apex ← **Anterior**

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--The inferior portion below it

*What structures pass through the annulus itself?*
--The nasociliary nerve
--CN3
--CN6
Motility Disorders: The Sinus, the Fissure, and the Apex

Superior orbital fissure

What bony relationship forms the SOF?
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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 superior and inferior divisions.

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 inferior portion below it
--The intra-annular portion

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

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

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

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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**

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

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

*The annulus divides the SOF into three sections. What are they called?*

--The superior portion is above the annulus
--The infero-annular portion
--The inferior portion below it.

*By dint of its location, the annulus straddles a very important structure. What is the eponymous name of this structure?*

The annulus of Zinn.

*What structures pass through the annulus itself?*

--The nasociliary nerve
--CN3
--CN6

*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

Superior orbital fissure

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.

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

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

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.

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.

Is CN3 a single entity as it passes through the SOF?
No—by the time it reaches the SOF, CN3 has already split into superior and inferior divisions.

Which nerves pass through the annulus itself?
- The nasociliary nerve—CN3
- CN6

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

Superior orbital fissure

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.

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

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

Is CN3 a single entity as it passes through the SOF?
No—by the time it reaches the SOF, CN3 has already split into superior and inferior divisions.

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

Superior orbital fissure

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.

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

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

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

Is CN3 a single entity as it passes through the SOF?
No—by the time it reaches the SOF, CN3 has already split into superior and inferior divisions.

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

Superior orbital fissure

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.

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

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

By dint of its location, the annulus divides the SOF into three sections.

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.

Which muscles pass through the annulus itself?
The nasociliary nerve, CN3, CN6.

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

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**

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** portion is below the annulus.
- The **inferior** portion is roughly the middle third.

What structures pass through the inferior portion?
Sometimes, the inferior ophthalmic vein passes through it.
Motility Disorders: The Sinus, the Fissure, and the Apex

Superior orbital fissure

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 portion is below the annulus
--The inferior portion

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

- Superior orbital fissure
- Superior ophthalmic vein
- Lacrimal nerve (CN Va)
- Frontal nerve (CN Va)
- Trochlear nerve (CN IV)
- Superior division of the oculomotor nerve (CN III)
- Nasociliary nerve (CN Va)
- Inferior division of the oculomotor nerve (CN III)
- Abducens nerve (CN VI)
- Tendinous ring (of Zinn)

Inferior ophthalmic vein: ★
Motility Disorders: The Sinus, the Fissure, and the Apex

Posterior ← Cavernous sinus Superior orbital fissure Orbital apex → Anterior

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

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 inferior portion is straddled by the annulus. Roughly the middle third
Motility Disorders: *The Sinus, the Fissure, and the Apex*

*Inferior orbital fissure*

*Inferior portion of the superior orbital fissure*

*Inferior orbital fissure*

Inferior portion of the superior orbital fissure vs the inferior orbital fissure
Motility Disorders: The Sinus, the Fissure, and the Apex

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

What bony relationship forms 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

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

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

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

Superior orbital fissure

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

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.

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.

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Cavernous sinus

The orbital apex

Orbital apex

Posterior

Anterior

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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.

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

Inferior orbital fissure
Motility Disorders: The Sinus, the Fissure, and the Apex

Superior orbital fissure

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

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

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

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!
**Superior orbital fissure**

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.

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

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

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.

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

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

**Posterior** → **Anterior**

**Superior orbital fissure**

*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.

*What is the annulus of Zinn?*

It is a ring-shaped structure formed by the tendinous insertions of the four rectus muscles.

*What portion of the SOF is straddled by the annulus?*

Roughly the middle third.

*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.

*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)
Inferior orbital fissure and its associated structures
Motility Disorders: The Sinus, the Fissure, and the Apex

Superior orbital fissure

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

What sort (i.e., 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?
- Infraorbital nerve and artery
- Zygomatic nerve and artery
- Postganglionic parasympathetics heading up from the pterygopalatine ganglion to the lacrimal gland
- Inferior ophthalmic vein (sometimes)

By the way. Are the terms ‘inferior orbital fissure’ and ‘inferior portion of the SOF’ synonyms?
No! The inferior orbital fissure is a separate and distinct structure from the inferior portion of the SOF. Don’t get them confused!
**Motility Disorders: The Sinus, the Fissure, and the Apex**

**Superior orbital fissure**

*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.

*What is the annulus of Zinn?*

It is a ring-shaped structure formed by the tendinous insertions of the four rectus muscles.

*What portion of the SOF is straddled by the annulus?*

Roughly the middle third.

*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

*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.

*What bony relationship forms the inferior orbital fissure?*

It is formed by a gap in the confluence between 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)

*What sort (i.e., 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).
**Motility Disorders: The Sinus, the Fissure, and the Apex**

**Superior orbital fissure**

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

*What sort (i.e., 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 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!)

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**Orbital apex**

---

**Cavernous sinus**

---

**Posterior** ←

**Anterior**

---

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

What sort (i.e., 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 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 annulus of Zinn

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

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

---

The superior portion is above the annulus
The intra-annular portion
The inferior portion below it
Motility Disorders: The Sinus, the Fissure, and the Apex

Superior orbital fissure

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.

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

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

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

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.

What structures pass through the inferior orbital fissure?

---The infraorbital nerve and artery
---The zygomatic nerve and artery
---Postganglionic parasympathetics heading up from thepterygopalatine ganglion to the lacrimal gland
---The inferior ophthalmic vein (sometimes)

What sort (i.e., 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).

The inferior orbital fissure is formed by a gap in the confluence between the orbital bones comprising the floor and medial wall.

---The infraorbital nerve and artery
---The zygomatic nerve and artery
---Postganglionic parasympathetics heading up from thepterygopalatine ganglion to the lacrimal gland
---The inferior ophthalmic vein (sometimes)
Motility Disorders: The Sinus, the Fissure, and the Apex

 Superior orbital fissure

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

What is the SOF about 2 cm long?

The SOF is straddled by a very important structure--the annulus of Zinn.

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

Roughly the middle third of the SOF is straddled by the annulus.

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

Cavernous sinus

Superior orbital fissure

Orbital apex

Posterior

Anterior

- 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!

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

As stated earlier in the slide-set, this is how CS pathology presents clinically. How does SOF pathology present?
Motility Disorders: The Sinus, the Fissure, and the Apex

Posterior \(\leftarrow\) Superior orbital fissure \(\rightarrow\) Orbital apex

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.

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

--CN6
--CN3
--CN4
--V1
--V2

--Postganglionic sympathetics:

--Engorged ocular surface veins
--Increased IOP
--Chemosis
Motility Disorders: The Sinus, the Fissure, and the Apex

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

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

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.

Posterior

Anterior

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

Engorged ocular surface veins
Increased IOP
Chemosis
Motility Disorders: The Sinus, the Fissure, and the Apex

- Cavernous sinus
- Superior orbital fissure
- Orbital apex

Posterior  Anterior

Superior orbital fissure

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

In the exact same manner

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.

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.

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

- Engorged ocular surface veins
- Increased IOP
- Chemosis

CS pathology and SOF pathology
Motility Disorders: The Sinus, the Fissure, and the Apex

Posterior  
Cavernous sinus  Superior orbital fissure  Orbital apex  Anterior

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

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

**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

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

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

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!

- Engorged ocular surface veins
- Increased IOP
- Chemosis

Posterior ← Cavernous sinus Superior orbital fissure Orbital apex → Anterior