

Cavernous Sinus Thrombosis

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Learning outcome

- Knowledge about the anatomy of cavernous sinus (C1)
- Understand the significance of cavernous sinus (C2)
- Understand the importance of cavernous sinus thrombosis (C2)
- Knowledge about Medical management of cavernous sinus (C1)

Dural Venous Sinuses

- The Dural venous sinuses are spaces **between** the periosteal and meningeal layers of **dura mater**, which are lined by **endothelial** cells.
- They collect venous blood from the veins that drain the brain and bony skull, and ultimately drain into the internal jugular vein.

Classification

Paired venous sinuses

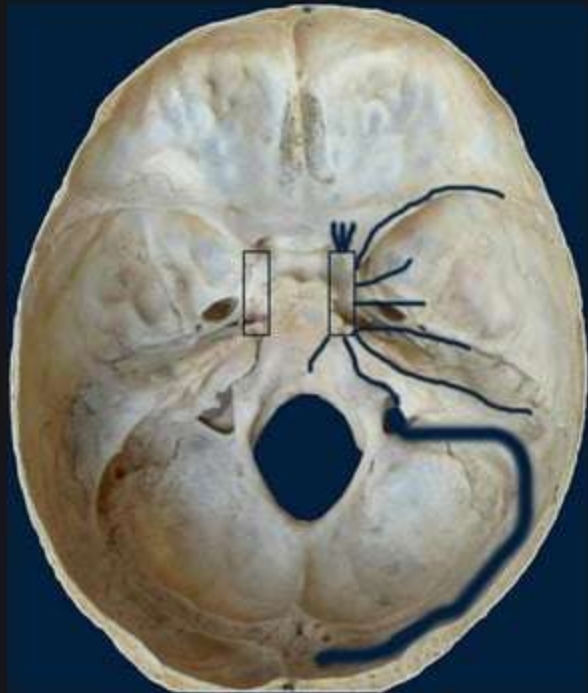
- ***Cavernous sinuses***
- Petrosal sinuses
- Transverse sinuses
- Sigmoid sinuses
- Spheno parietal sinuses

Unpaired venous sinuses

- Superior sagittal sinus
- Inferior sagittal sinus
- Straight sinus
- Occipital sinus
- Basilar plexus of sinuses

Cavernous sinus Anatomy

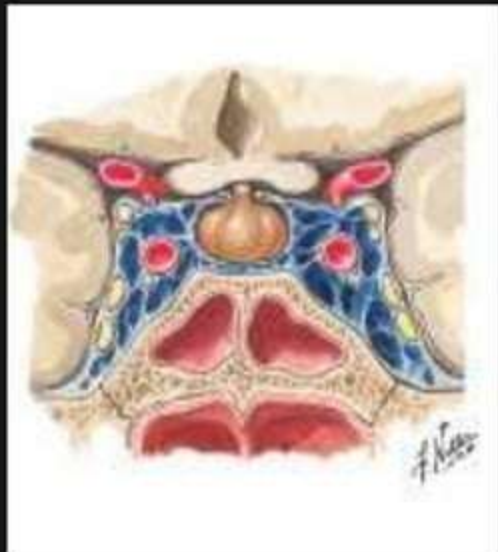
- Large venous space *situated in the middle cranial fossa*, on either side of body of the sphenoid bone.
- Each sinus is about 2 cm long and 1 cm wide.
- Interior is divided into a number of *spaces or caverns* by trabeculae.

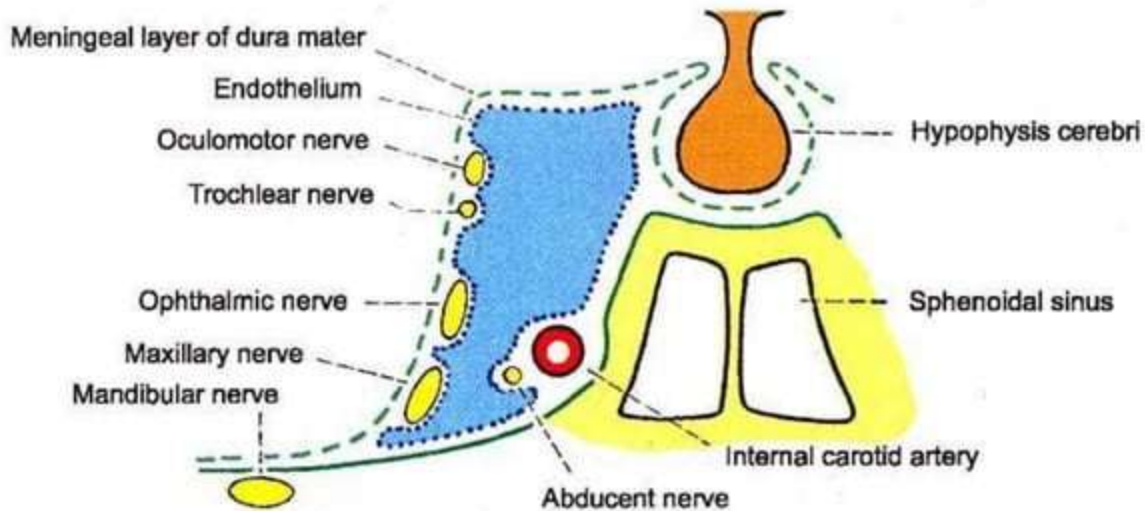


Cavernous sinus Anatomy

Boundaries

- **Anterior** - extends into medial end of superior orbital fissure.
- **Posterior** – up to apex of petrous temporal bone.
- **Medial** – Pituitary above and sphenoid below
- **Lateral** – temporal lobe and uncus
- **Superior** – optic chiasma
- **Inferior** - endosteal dura mater, greater wing of sphenoid



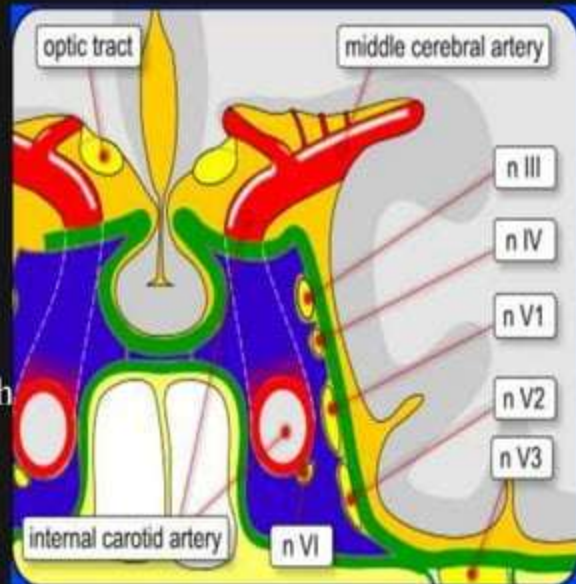


Coronal section through the middle cranial fossa showing the relations of the cavernous sinus.

Contents

■ Superior to inferior (within the lateral wall of the sinus)

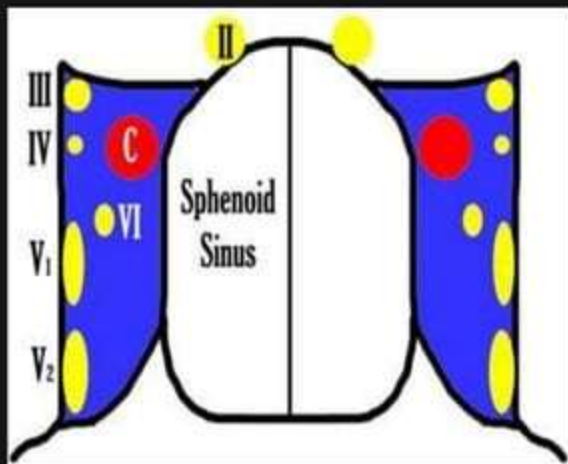
- **oculomotor nerve** (CN III)
- **trochlear nerve** (CN IV)
- **ophthalmic nerve**, the V₁ branch of the trigeminal nerve (CN V)
- **maxillary nerve**, the V₂ branch of CN V



Contents

abducens nerve (CN VI) runs through the middle of the sinus alongside the **internal carotid artery** (with sympathetic plexus)

These nerves, except the CN V₂, pass through the cavernous sinus to enter the orbital apex through the superior orbital fissure.



Communications

1. Transverse sinus via Sup. petrosal sinus
2. Int. Jugular vein through inf. petrosal sinus
3. Pterygoid venous plexus through emissary veins
- foramen ovale, spinosum and lacerum
4. Facial vein through sup. Ophthalmic vein & angular vein or pterygoid venous plexus and deep facial vein
5. Opposite. Cavernous sinus through ant / post inter cavernous sinuses
6. Sup. Sag. Sinus through Middle cerebral vein and & sup. Anastomotic vein

Ant. intercavernous

Sphenoparietal

Cavernous

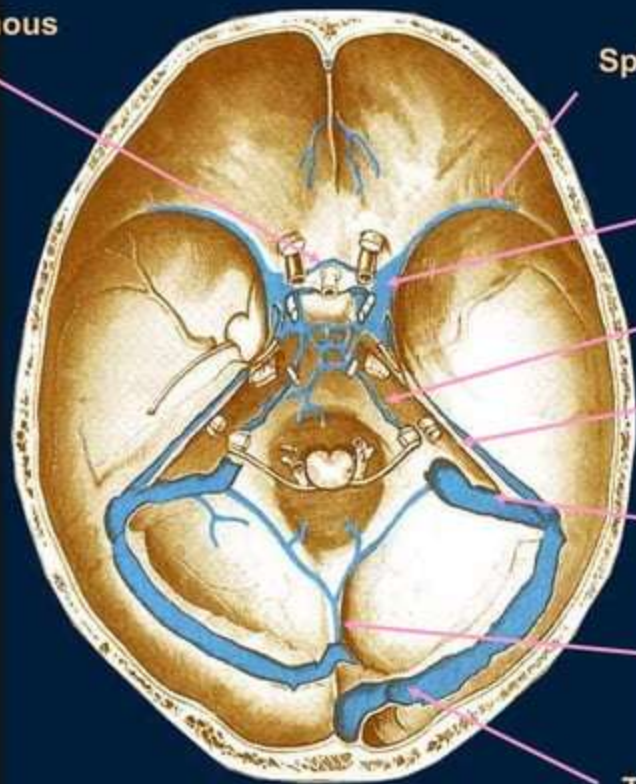
Inf. petrosal

Sup. petrosal

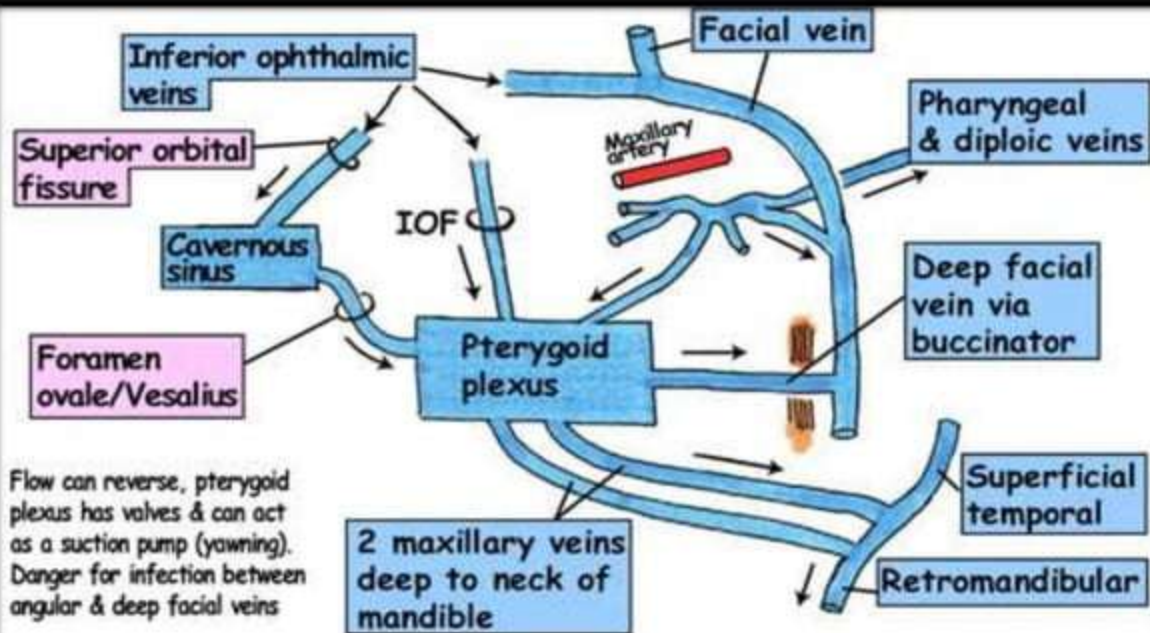
Sigmoid

Occipital

Transverse



Venous connections of cavernous sinus



Danger area of face

Spread of infection can lead to thrombosis
of cavernous sinus

The cavernous communicate with

danger area of face through 2 routes

- ✓ Superior ophthalmic vein
- ✓ Deep facial veins , pterygoid plexus of vein , emissary vein.



Spread of infection to cavernous sinus

1. Infection of the upper lip, vestibule of the nose and eyelids → spread by way of the angular, supra orbital and supra trochlear veins to the ophthalmic veins. **Commonest route** of infection.
2. Intranasal operations on the septum, turbinates or ethmoid / sphenoid sinus infection → through the ethmoidal veins.

Spread of infection to cavernous sinus

3. Operations on the tonsil, peritonsillar abscess, surgery or *osteomyelitis of the maxilla, dental extraction* and deep cervical abscess → spread by pterygoid plexus or by direct extension to the internal jugular vein.
4. Involvement of the middle ear and mastoid with lateral sinus phlebitis or thrombosis → retrograde spread through the petrosal sinuses to the cavernous sinus.

Etiology of CST

Septic CST

- Infectious

Aseptic CST

Trauma

Post surgery

- Rhinoplasty
- Cataract extraction
- Basal skull (including maxillary)
- *Tooth extraction*

Hematologic

- Polycythemia rubra vera
- Acute lymphocytic leukemia

Malignancy

- Nasopharyngeal tumor

Other

- Ulcerative colitis
- Dehydration
- Heroin

Septic cavernous sinus thrombosis

Most commonly results from contiguous spread of infection from

- the nose (50%),
- sphenoidal or ethmoidal sinuses (30%) and
- dental infections (10%).
- *Staphylococcus aureus* is the most common - found in 70% of the cases.
- *Streptococcus* is the second leading cause.
- Gram-negative rods and anaerobes may also lead to cavernous sinus thrombosis.
- Rarely fungal (*Aspergillus fumigatus* and mucormycosis).

Dental Infections

- The upper and lower jaws and their teeth are drained by the superior and inferior alveolar veins which are tributaries (directly or indirectly) to the pterygoid venous plexus.
- This plexus lies in the infra temporal fossa and communicates with the cavernous sinus via an emissary vein passing through the foramen ovale.
- Infection could therefore spread from the jaws to the pterygoid plexus and then into the cavernous sinus via this emissary vein.

Cavernous Sinus thrombosis

Characterized by multiple cranial neuropathies

Clinical feature :

- ✓ General feature of infection – fever , rigors ,malaise, and severe frontal & periorbital pain.
- ✓ U/L exophthalmoses & tender eye ball
- ✓ Edema of eyelid & chemosis of conjunctiva

Oculomotor feature :

- ✓ External ophthalmoplegia
- ✓ Ptosis
- ✓ Slight exophthalmos
- ✓ dilated pupil with loss of accommodation reflex

Cavernous Sinus thrombosis

- Impairment of ocular motor nerves, Horner's syndrome and sensory loss of the first or second divisions of the trigeminal nerve in various combination
- **The pupil may be involved or spared or may appear spared with concomitant oculo sympathetic involvement.**

Clinical features

- Infections from face, orbit, sphenoid sinus can cause thrombosis.
- III,IV,V1,V2,VI can be involved resulting in various diplopias
- Rupture of ICA can cause pulsatile exophthalmos

Caput medusae in cavernous sinus thrombosis



Cavernous sinus thrombosis



Cavernous sinus thrombosis



Ocular manifestation of cavernous sinus thrombosis

<i>SIGN</i>	<i>INVOLVED STRUCTURES</i>
Ptosis	Edema of upper eye lid Sympathetic plexus III cranial nerve
Chemosis	Thrombosis of superior and inferior ophthalmic vein
Proptosis	Venous engorgement
Sensory loss/ Periorbital pain	V cranial nerve
Corneal ulcers	Corneal exposure due to proptosis
Lateral rectus palsy	VI cranial nerve
Complete ophthalmoplegia	CN II, IV, VI
Decreased visual acuity or blindness	Central retinal artery/ vein occlusion secondary to ICA arteritis, septic emboli, ischemic optic neuropathy

Complications of Cavernous Sinus thrombosis

- Intracranial extension of infection may result in meningitis, encephalitis, brain abscess, pituitary infection, and epidural and subdural empyema.
- Cortical vein thrombosis can result in hemorrhagic infarction.
- Extension of the thrombus to other sinuses can occur.

Imaging of cavernous sinus

Cavernous sinus on CT Head



Cavernous sinus

Cavernous sinus on MRI Brain

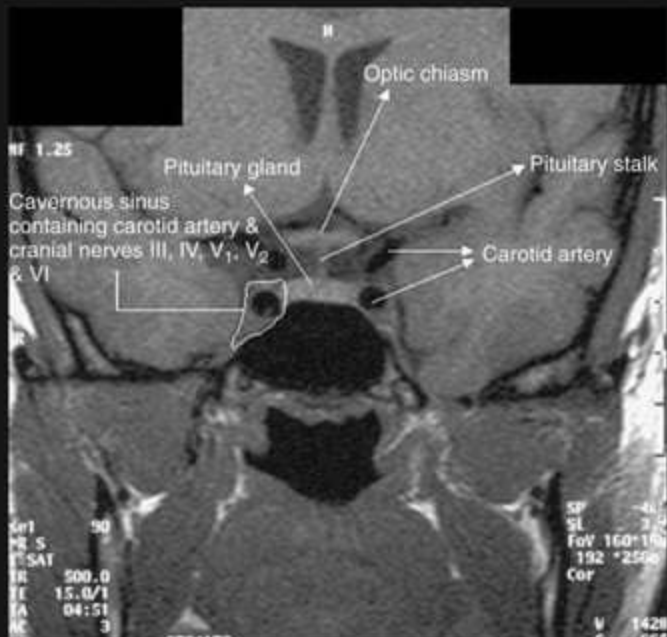
Axial section



Coronal section



Cavernous sinus on MRI Brain



- MR image at the level of the pituitary stalk shows bilateral involvement of the cavernous sinuses with narrowing of the right internal carotid artery due to infiltration of the lesion (arrows).



TREATMENT OF CAVERNOUS SINUS THROMBOSIS

TREATMENT OF CAVERNOUS SINUS THROMBOSIS

Septic cavernous sinus thrombosis –

- **The mainstay of therapy is early and aggressive antibiotic administration.**
- Although *S aureus* is the usual cause, broad-spectrum coverage for gram-positive, gram-negative, and anaerobic organisms should be instituted pending the outcome of cultures.
- Empiric antibiotic therapy should include a penicillinase-resistant penicillin plus a third generation cephalosporin.
- Vancomycin may be added for MRSA.
- **IV antibiotics are recommended for a minimum of 3-4 weeks.**

TREATMENT OF CAVERNOUS SINUS THROMBOSIS

- The indication of **anticoagulation is still debated** because of possible bleeding complications and an eventual suppressive role of the thrombus on the extension of the infectious thrombophlebitis.
- Limited evidence suggests anticoagulant drugs are probably safe and may be beneficial for people with sinus thrombosis.
- **Anticoagulant is contraindicated in the presence of intra cerebral hemorrhage or other bleeding diathesis.**

Fungal infection

- Intracranial extension is the most dreaded complication of fungal sinusitis with high mortality rates.
- Aspergillus is the most common.
- Mucormycosis also occurs but rare
- Uncontrolled diabetics are more susceptible to mucormycosis .
- The clinical signs of Mucormycosis are commonly ophthalmoplegia, proptosis, blindness, palatal ulcer, coma and stupor.

- Mode of spread =
 - Hematogenous spread
 - Direct extension

Fungal infection - treatment

- Line of management-included debridement, clearing of disease from the sinuses and antifungal therapy with systemic Amphotericin B.
- **Posaconazole (Noxafil)** a triazole, is currently considered a second-line drug for treatment of mucormycosis and the typical dose is 400 mg twice daily (total of 800 mg/d).
- Patients on posaconazole should avoid antacids, especially proton pump inhibitors.
- Posaconazole has also been used as sequential therapy after the initial administration and control of the disease with amphotericin B.
- **Voriconazole** is the preferred agent against aspergillus.

Prognosis

- 100% mortality prior to effective antimicrobials
- Typically, death is due to sepsis or central nervous system (CNS) infection.
- With aggressive management, the mortality rate is now less than 30%.
- Morbidity, however, remains high, and complete recovery is rare.
- Roughly one sixth of patients are left with some degree of visual impairment, and one half (50 %) have cranial nerve deficits.

REFERENCES

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THANK YOU