

The EM Educator Series

The EM Educator Series: Cavernous Sinus Thrombosis

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Case 1: A 35-year-old female with a recent diagnosis of sinusitis presents with worsening headache, eye pain, nausea, and double vision for 3 days. Her symptoms started with facial pain and nasal congestion approximately 1 week ago. She has a history of diabetes type II on metformin. Exam reveals BP 118/55, HR 108, RR 17, T 37.2 C. Exam reveals difficulty looking laterally with the left eye. Her visual acuity is normal, and her strength and sensation are also normal.

Questions for Learners:

1. What are the pertinent features of the cavernous sinus anatomy?
2. What are risk factors for cavernous sinus thrombosis?
3. What are the various ways cavernous sinus thrombosis can present?
4. What is the ED work-up for cavernous sinus thrombosis?
5. What is the ED management of cavernous sinus thrombosis?

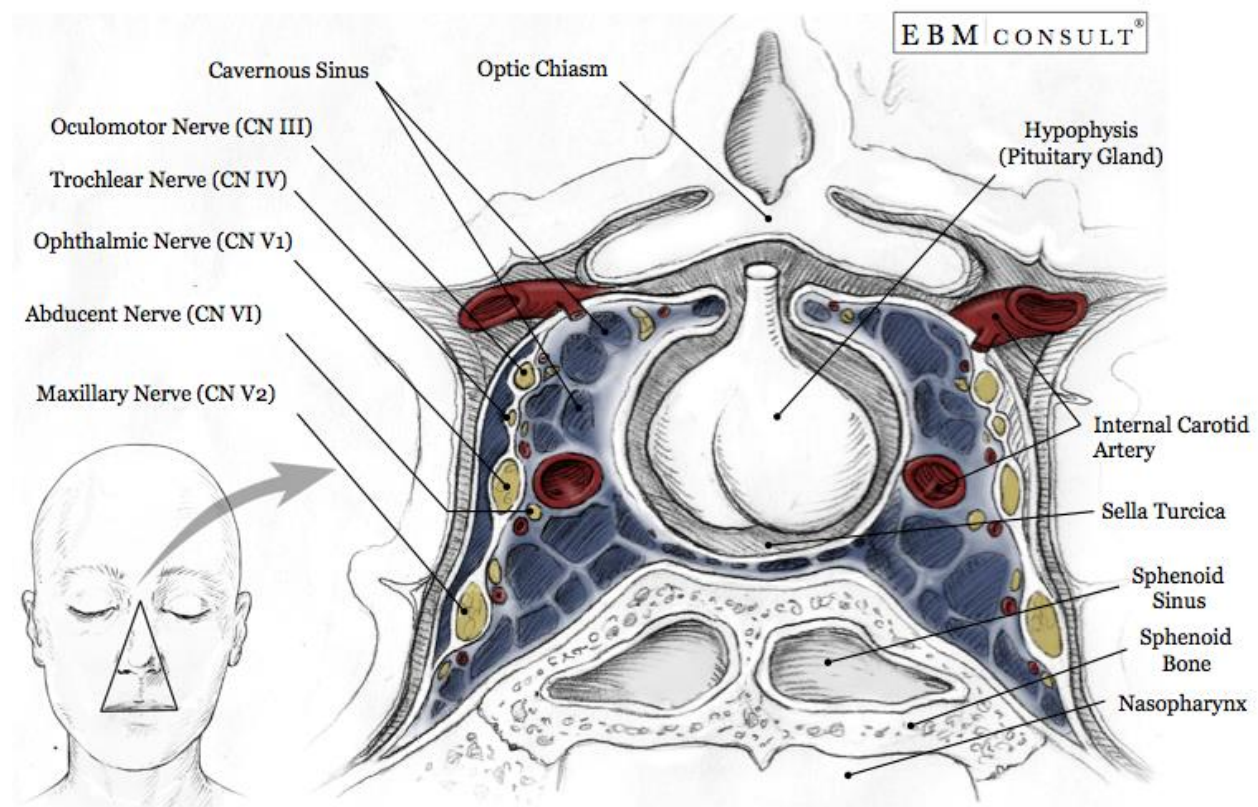
Suggested Resources:

- Articles
 - [emDOCs CST](#)
 - [Ped EM Morsels CST](#)
 - [Radiopaedia](#)
- Journal Articles
 - [JEM](#)
 - [EMJ](#)

Answers for Learners:

1. What are the pertinent features of the cavernous sinus anatomy?

The two cavernous sinuses are located on both sides of the sella turcica. Important structures are located in, or run through, the cavernous sinus, including the pituitary gland, cranial nerves III, IV, V and VI, and the internal carotid arteries (ICA). The cavernous sinuses receive blood from the superior ophthalmic and cerebral veins, the sphenoparietal sinuses, and emissary veins. The cavernous sinuses also communicate with the deep facial and inferior ophthalmic veins. Many of these veins have no valves and blood can flow in either direction, depending on pressure gradients. It is hypothesized that this is the reason why infection spreads and thromboses form. In addition, the thrombus itself is a good growth medium for bacteria and the bacteria, in turn, stimulate thrombosis by releasing substances that cause tissue damage.



- The **anatomy** of the Cavernous Sinus is important to consider.
 - It is an irregular shaped space **lined with endothelium**.
 - It is on either side of the **sella turcica**.
 - It is lateral and superior to the **sphenoid sinus**.
 - It is immediately posterior to the **optic chiasm**.
- Venous drainage is from the “**Danger Triangle!**”
 - Region from the **corners of the mouth to the bridge of the nose and inclusive of the nose and maxilla**.
 - Venous drainage from:

- **Superior and Inferior Ophthalmic Veins**
- **Sphenoid and Middle Cerebral Veins**
- **Facial Vein**
- Also drainage from frontal sinuses.
- The connecting veins to and from the Cavernous Sinus lack valves so **blood can flow in either direction...** and thrombosis can migrate in both directions. [Varshney, 2015]

2. What are risk factors for cavernous sinus thrombosis?

Sphenoid and ethmoid **sinusitis** are the most common causes of CST. Other risk factors include dental infections, facial cutaneous infections, otitis media, maxillofacial surgery, and trauma. Even bacterial seeding from a distant site of infection has been a reported cause of CST. Staphylococcus aureus is the primary organism that causes CST, but many other bacteria can be involved.

- Cavernous Sinus Thrombosis is an **associated complication of:**
 - [Bacterial Meningitis](#)
 - [Sinusitis](#)
 - [Otitis Media](#)
 - [Dental Abscess](#)
 - [Facial Soft-tissue Infections](#) (ie, mid-face furuncle, facial acne, facial cellulitis)
 - [Orbital Cellulitis](#)

3. What are the various ways cavernous sinus thrombosis can present?

CST can present acutely or sub-acutely. Most patients will have fever, headache, proptosis, periorbital edema and/or chemosis. Most will also have external ophthalmoplegia, due to venous congestion of orbital tissues, extra-ocular muscle inflammation and/or inflammation of cranial nerves III, IV and VI. Other symptoms include eyelid erythema, autonomic dysfunction, sensory changes in the ophthalmic and maxillary trigeminal nerve distributions, pupillary abnormalities, and papilledema. Vision loss is rare as the orbital nerve lies outside the cavernous sinus but it can occur via other mechanisms such as occlusion of the ICA, ophthalmic or central retinal arteries, orbital congestion, or arteritis. CST commonly spreads from one eye to both within 24 to 48 hours.

- **Potential complications of Sinus Thrombosis include:**
 - Injury to any of the structures contained within the Cavernous Sinus:
 - **CNs III, IV, V1, V2, VI**
 - **Internal carotid artery**
 - **Pituitary gland**
 - Involvement in contiguous / adjacent structures:
 - **Thrombosis of ophthalmic vein**
 - **Retinal infarction**
 - [Internal jugular vein thrombosis](#) → septic emboli, PNA, empyema
 - **Meningitis, dural empyema, cerebral abscess**
- **Prompt recognition is key** to limiting complications!
 - “Classic Presentation” = severe illness with high, fluctuating fevers in the setting of recent mid-face infection.
 - Common symptoms:

- **Severe Headache**
- **Periorbital Swelling**
- **Ptosis**
- **Inability to Move Eyes**
- **Pain / Numbness around midface and eyes**
- **Vision Changes / Double Vision / Loss of Vision**
- **Seizures**
- **High Fevers**

4. What is the ED work-up for cavernous sinus thrombosis?

If CST is suspected, imaging should be ordered. Either computed tomography (CT) or magnetic resonance imaging (MRI) may be obtained, but CT tends to be the initial test of choice, as it is better than MRI in detecting thrombus directly in the cavernous sinus. MRI, however, is better at detecting dural venous sinus thromboses. On CT, various direct and indirect findings of CST may be found. Direct signs include enlargement of the cavernous sinuses, convex bowing of the lateral wall of the cavernous sinus and/or abnormal filling defects. Indirect signs include dilation of the superior ophthalmic vein, exophthalmos, and/or increased dural enhancement along the lateral wall of the sinus.

- Imaging:
 - **Contrast-enhanced CT**
 - Useful, but has radiation concerns.
 - **Contrast-enhanced MRI**
 - More difficult to come by in the ED.
 - Not MRV. MRV (venogram) has been found to miss some cases.
 - The slow turbulent flow may allow thrombus to be missed on MRV.

5. What is the ED management of cavernous sinus thrombosis?

Antibiotics are primary in the treatment of CST. Empiric therapy should consist of a third generation cephalosporin, nafcillin, and metronidazole. Vancomycin can be substituted for nafcillin if methicillin-resistant *Staphylococcus aureus* (MRSA) is a concern. Along with antibiotics, surgery may be necessary; it is rarely needed for drainage of the primary infection.

The use of anticoagulation and corticosteroids remains controversial. Some studies have found improved cranial nerve function with steroid use, but there is currently no data to support its routine use.

Regarding anticoagulation, data is also limited given the rarity of CST and the lack of prospective trials. It is theorized that anticoagulation may prevent the spread of the thrombus to other sinuses as well as help dissolve the clot, allowing the antibiotic to reach the infected thrombus more readily. On the other hand, there is a risk of systemic and intracranial bleeding and some authors state it may result in dissemination of septic emboli. Most authors recommend considering anticoagulation only if there is no evidence of severe bleeding risk or current hemorrhage by history, exam, and imaging. It is always best to consult with specialists regarding treatment regimens

- There is **no current consensus** guidelines for management of Cavernous Sinus Thrombosis.
- Therapy typically includes:

- **Antimicrobials**
 - Empiric antibiotics (ex, **Cephalosporin AND Metronidazole AND Vancomycin**) should be initiated early.
 - Typical bacterial infections include:
 - **Staph**
 - **Strep**
 - **Anaerobic bugs**
 - **Fungal infections** (ex, Aspergillus, Rhizopus) have been shown to be important considerations in:
 - Immunocompromised patients
 - Diabetic patients
 - Patients on chronic steroids
- **Anticoagulation**
 - NO consensus on utility of anticoagulation.
 - May be used due to concern for concurrent [Cerebral Venous Sinus Thrombosis](#).
- **Surgery**
 - Functional Endoscopic Sinus Surgery has been advocated for, but not often required emergently.
 - Consultation with ENT early is important to help coordinate care for those who are not improving on antibiotics.