Cavernous Sinus Meningioma

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The cavernous venous sinus is a small blood-filled space on both sides of the base of the skull located behind the eyes. The cavernous sinuses contain the carotid artery, cranial nerves III, IV, V₁ and V₂ branch of cranial nerve V, and cranial nerve VI.

A meningioma is a tumor that grows from the meninges, the membrane that surrounds the brain and spinal cord. Meninges have three layers of membrane: dura mater, arachnoid mater, and the pia mater. Meningiomas are mostly benign and grow slowly. Meningiomas often tend to grow inward causing pressure on the brain or spinal cord. Meningiomas can also grow outward causing the skull to thicken.

Meningioma represents about twenty percent of all primary brain tumors and twelve percent of all spinal cord tumors. Cavernous Sinus Meningioma occurs in children, however, most occur in adults between the ages of 30 and 70 years. Most malignant meningiomas affect women and men equally. However, benign meningiomas occur more often in women. Common signs and symptoms of meningioma are headaches, double vision, seizures, changes in personality or behavior, confusion, hearing loss, ringing in ears, and drowsiness.

The World Health Organization, WHO, developed the classifications of meningiomas. Meningiomas are “Classified [into three grades] by their cell type and grade by viewing the cells taken from a biopsy under a microscope.” Grade I meningiomas are the slowest growing. Grade II meningiomas are called atypical and are slightly more aggressive in growth compared to Grade I. Grade II meningiomas have a slightly higher risk of recurrence. Grade III meningiomas are the most aggressive and are called malignant or anaplastic.

To diagnosis a meningioma, the doctor performs a neurological exam to check for the mental status and memory, cranial nerve function, muscle strength, coordination, reflexes, and response to pain. If a problem is found, the doctor may order diagnostic imaging tests such as
computerized tomography, CT, or magnetic resonance imaging, MRI, scans to help determine the size, location, and type of tumor, if one exists.³

Depending on the grade of the meningioma and the symptoms, the treatment will vary. In most cases the growth of the tumor is monitored with the main focus of removing the tumor to relieve any pressure on the brain. If surgery is required, a complete surgical resection is performed.³ In some cases, stereotactic radiotherapy may also be needed. Stereotactic radiotherapy controls the tumor growth with minimal complications. Radiotherapy does not shrink the tumor.⁵ It is recommended that the patient get regular follow-ups with MRI or CT scans every one to three years.³

Since the cavernous sinus contains the carotid artery, cranial nerve III, cranial nerve IV, V₁ and V₂ branch of cranial nerve V, and cranial nerve VI, cavernous sinus meningiomas can affect all of these nerves. Cranial nerve IV innervates the superior oblique muscle which turns the eye down and in when contracted.¹ Cranial nerve V also known as Trigeminal nerve is the largest cranial nerve.² Cranial nerve V is further divided into three branches: ophthalmic (V₁), maxillary (V₂), and mandibular (V₃).² Cranial nerve VI also known as the Abducens nerve is a motor nerve that originates in the pons and performs the function of turning the eye laterally.² Cranial nerve VI innervates the lateral rectus muscle which has a primary action of abducting the eye.¹ Cranial nerve VI palsies affect the lateral rectus muscle causing esotropia.

Case Study

A 48 year-old white female comes in to clinic and states, “I was referred here by my neurologist because I had a brain tumor removed that affected my eye.” According to the neurologist’s notes, the patient came in complaining with right facial numbness. An MRI scan was performed, and it showed a homogeneous cavernous sinus mass encasing the right fourth, fifth, and sixth cranial nerves. The mass was resected and biopsied. Pathology stated it was a Grade I meningioma. The MRI scans can be seen in Figure 1 and Figure 2.

The patient also complains, “The right eye will not blink or move, and that vision is not good.” The patient denies dry eyes or having any ocular pain. With correction of -5.00 + 0.50 x 082 and -5.50 + 1.25 x 050, the patient had a visual acuity of 20/50 and pinholed to 20/40 with the right eye and 20/60 pinholed to 20/40 in the left eye. The patient’s pupils were normal and
reacted to light. The patient had intraocular pressures that were within normal limits. However, the patient could not abduct the right eye and showed a “V” pattern on motility. The patient also had a right esotropia.

![Figure 1. Coronal cut of an MRI scan of a Right Cavernous Sinus Meningioma. A homogeneous mass measures 23mm.](image1)

![Figure 2. Axial cut of an MRI scan of a Right Cavernous Sinus Meningioma. A homogeneous mass measures 3.2 cm x 2 cm.](image2)

According to the doctor’s note, the patient had a Right Cranial nerve V, VI, and VII nerve palsies. The patient also had right neurotrophic keratopathy and right lagophthalmos. The patient had a normal Bell’s phenomenon, the eye involuntarily rolls upwards when the eye is closed. The patient was told to use frequent artificial tears and ointment for the treatment of the
neurotrophic keratopathy and to come back one week later. At the follow-up visit, the patient complained that “The right eye feels irritated.” The patient also stated that she is “Still using artificial tears and the ointment in the right eye.”

According to the doctor’s note, the patient’s eyelid function improved. The doctor also stated that the corneal sensitivity were the same in both eyes using the cotton tip test. Therefore, there was an improvement in corneal sensitivity and eyelid function. However, the patient still had facial numbness and a right peripheral 7th nerve weakness. The doctor advised the patient to continue to lubricate the right eye with Preservative Free Artificial Tears and ointment and to return to clinic in three months to reassess the 6th nerve function.

Conclusion

Cavernous sinus meningioma is a tumor growing from the meninges that is located in the cavernous sinus. Meningioma can be classified into three grades. All the nerves in the cavernous sinus can be affected. Treatment varies depending on the grade of the meningioma. Some Grade I tumors do not cause symptoms. Therefore, the best treatment may be to observe its growth over time with periodic MRI scans. However, if the growing tumor causes symptoms, then surgical removal may be recommended. Most Grade I meningiomas are treated with surgery and continued observation. Since Grade II meningiomas are more aggressive in growth, surgery is the first line treatment. Some Grade II meningiomas require radiation after surgery. Grade III meningiomas require surgery followed by radiation. If the tumor recurs, chemotherapy is used. Patients are recommended to get MRI scans every one to three years to monitor the growth or to detect if there is a recurrence.

This 48 year-old white female had a grade I meningioma in the right cavernous sinus. The patient was showing symptoms, therefore, the tumor was removed. The tumor caused the palsies of the fifth, sixth, and seventh cranial nerves. The palsies caused the decreased corneal sensitivity and decreased eyelid function in the right eye. The tumor also caused the facial numbness and the right esotropia.

References
2. "Functions and Placements of 12 Cranial Nerves." 12cranialnerves.net. Web. 01 June 2014
4. MRI scans courtesy from Jones Eye Institute.