Case Report

MRI Findings of the Cavernous Sinus Metastasis with Inferior Extension Mimicking a Nasopharyngeal Carcinoma with Cavernous Sinus Invasion

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The authors report the MRI findings in a patient with cavernous sinus metastasis with inferior extension to the nasopharynx, mimicking imaging findings of the advanced nasopharyngeal cancer with the skull base, and intracranial extension. Findings of denervative atrophy of the masticator muscles and obstruction of the Eustachian tube resulting in fluid retention of mastoid air cells are seen in both processes.

Keywords: *Cavernous sinus, Metastasis, Nasopharyngeal cancer, Masticator muscle, Muscle denervation*

J Med Assoc Thai 2006; 89 (6): 890-5
Full text. e-Journal: *http://www.medassocthai.org/journal*

The cavernous sinus is not an uncommon location for metastasis. The common primary tumor for the cavernous sinus metastasis is known to be breast cancer in women and lung cancer in men[1-3]. However, prior to this report, there were few case reports on imaging findings of cavernous sinus metastasis as searched on MEDLINE[4-8].The invasion of the cavernous sinus from nasopharyngeal carcinoma appears to be more common. The cavernous sinus invasion can be seen at the first presentation in advanced cases or seen in recurrent cases.

Another common cavernous sinus tumor is the cavernous sinus meningioma. It can extend inferiorly to involve the posterior part of the eustachian tube, compromising multiple cranial nerves in the cavernous sinus, including CN III, IV, V, and VI. These processes cause the same clinical presentation and also the same imaging findings. Tumor mass in the cavernous sinus, fluid retention in the mastoid air cells, and denervative atrophy of the masticator muscles are seen.

In the present report, poorly differentiated squamous cell carcinoma was found at the cavernous sinus biopsy. After thorough investigation, the primary site could not be found. The patient was treated as nasopharyngeal carcinoma with radiation therapy (total dose of 6750 cGy divided in two courses and chemotherapy.

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Case Report

A 62-year-old man presented with right cranial nerve III, IV, and VI palsy with impaired vision of the right eye. MRI of the cavernous sinus was performed with spin echo (SE) T1W and fast spin echo (FSE) T2W with fat saturation and Gadolinium (GD) enhancement techniques. This revealed a right cavernous sinus lesion invading the adjacent structures as shown in Fig. 1 and 2.

Discussion

The cavernous sinus is a venous vascular structure situated between the layers of the dura, bordering the pituitary fossa and the sphenoid sinus. The cavernous sinus contains several nerves, including ophthalmic and maxillary divisions of the trigeminal nerve, oculomotor nerve, trochlear, and abducens nerves. The third division of the trigeminal nerve exits almost directly from the Meckel's cave and does not enter the cavernous sinus[4]. The lesion at the cavernous sinus can extend in any direction and to various structures, as seen in the presented case.

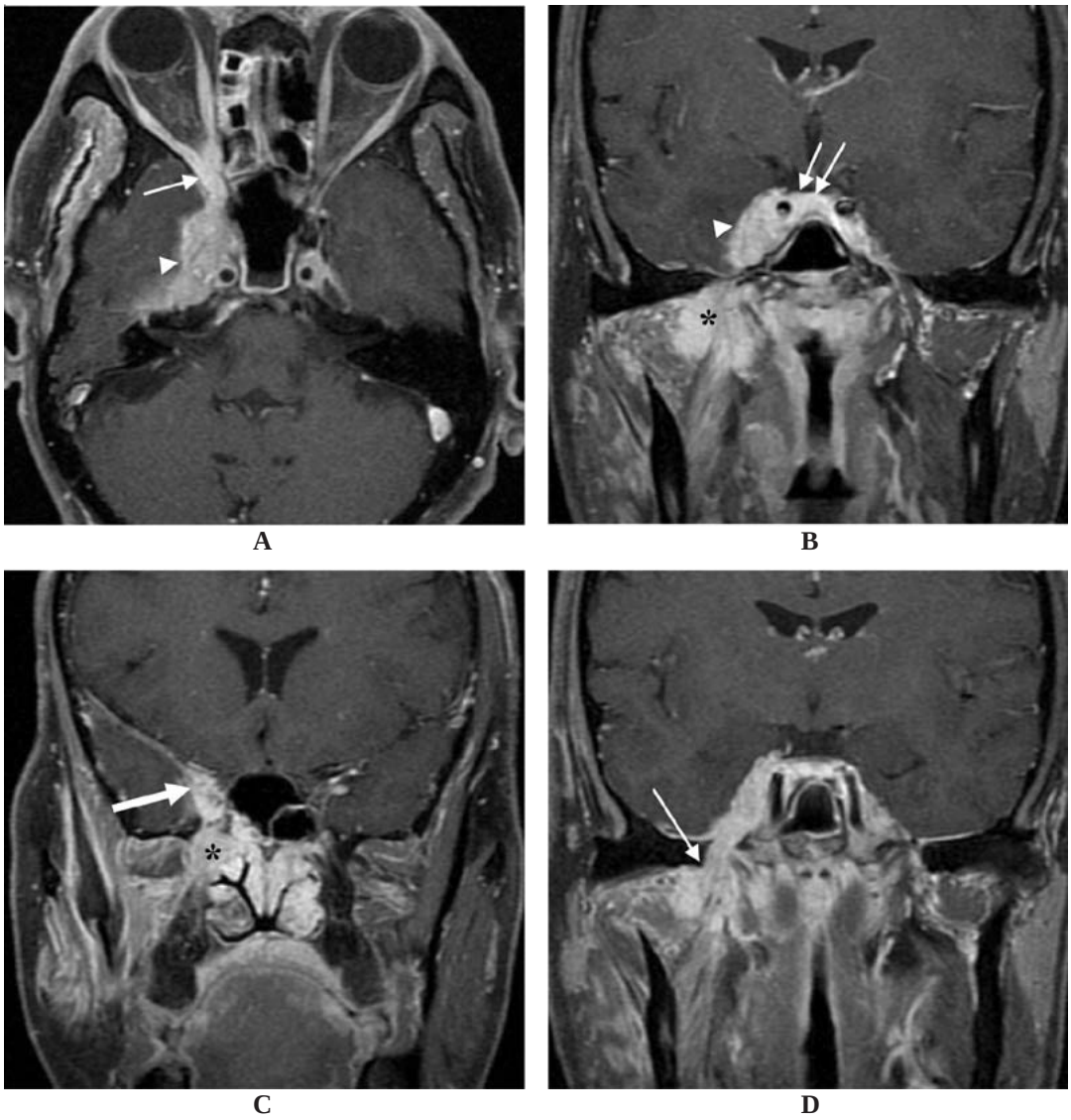


Fig. 1 MRI of the patient with the right cavernous sinus metastasis, post gadolinium axial (A) and coronal (B, C, D) T1W demonstrated an enhancing tumor originating in the right cavernous sinus (arrowhead), extending anteriorly to the orbital apex (thin arrow in A) and medially to the pituitary fossa (double arrow in B). Inferior extension of the tumor along the right lateral pharyngeal wall and infratemporal masticator space is observed (asterisk). The tumor mass invades the right superior and inferior orbital fissures (thick arrow) and pterygopalatine fissure (star in C). The tumor descends along the right foramen ovale to the infratemporal masticator space (thin long arrow in D)

There are many differential diagnoses for cavernous sinus mass. Unilateral cavernous sinus mass can be schwannoma, meningioma, metastasis, aneurysm, chordoma, or lymphoma[5].

Nasopharyngeal carcinoma originates from the mucosal space of the fossa of Rosen Muller and can spread along the preexisting vulnerable routes or direct invasion to the adjacent structures. The tumor can spread in an anterior direction to the posterior nasal cavity, pterygopalatine fissure, posterior ethmoid sinus, and orbits. Frequently, this tumor spreads in the inferior direction along the submucosal plane of the lateral and posterior walls of the nasophraynx. The tumor also spreads superiorly to the skull base by four common routes via muscular attachment of the levator veli palatini and tensor veli palatini, pharyngobasilar

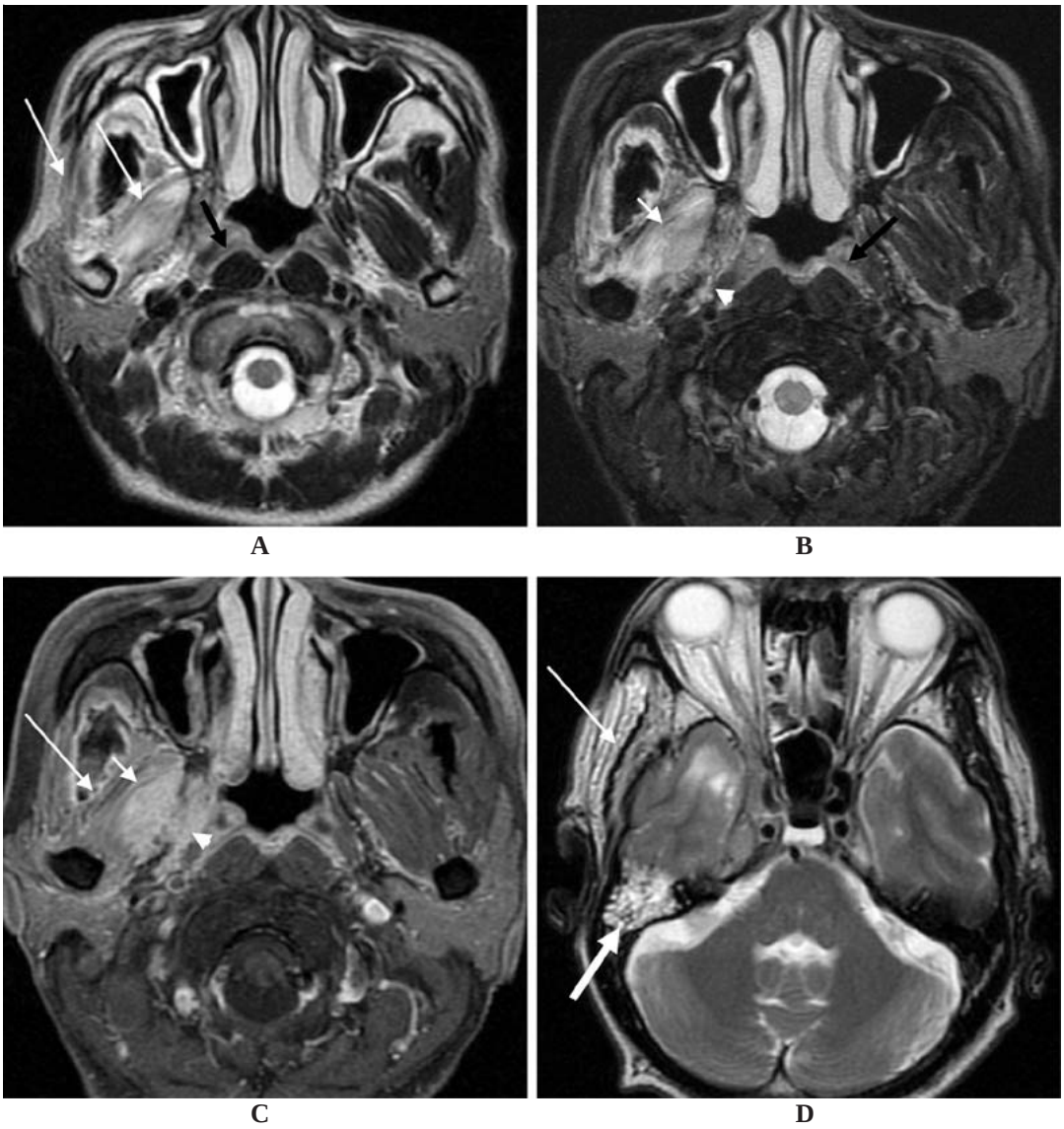
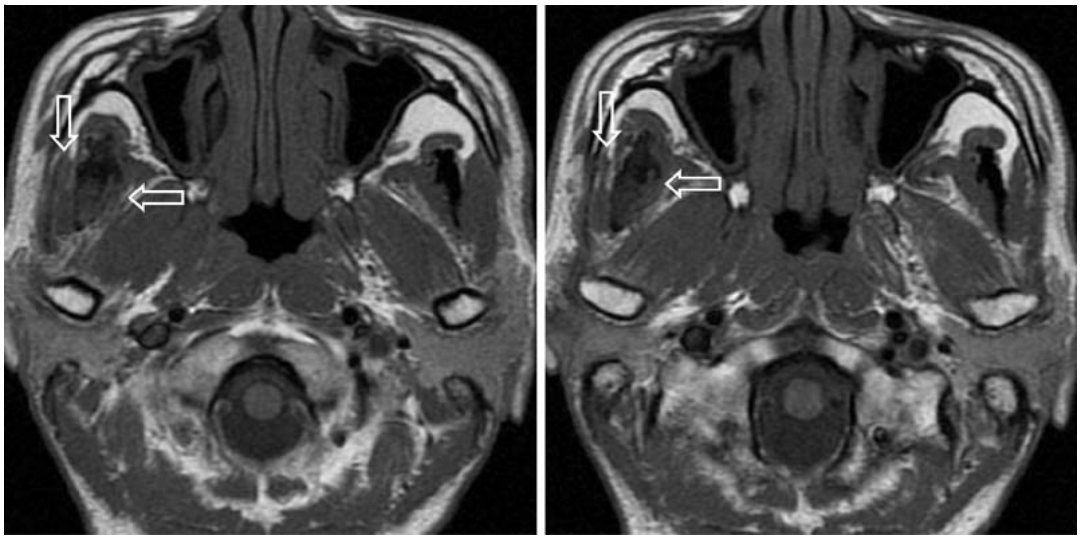


Fig. 2 Axial T2W with fat suppression (A) and (B), and post contrasted T1W with fat suppression (C) images show tumor invasion along the right eustachian tube (arrowhead) and medial pterygoid and medial portion of the lateral pterygoid muscles (small arrow in B and C). Atrophy with hypersignal T2 change and enhancement of the right muscles of mastication (thin long arrows in A, C, and D) is seen, including the massetter, lateral pterygoid, and temporalis muscles. Bilateral Rosen muller fossae proper appear normal (black arrow in A and B). (D) Axial T2W images show fluid retention in the right mastoid air cells (thick arrow in D)

fascial breakthrough, sinus of Morgagni, and direct invasion. In this direction, the tumor will reach the cavernous sinus through either the foramen lacerum or the foramen ovale that contains V3 segment of the cranial nerve V. If the V3 segment is involved, atrophic denervation of the masticator muscles will be seen. This must be distinguished from direct invasion by the tumor.

Meningioma is the most common tumor arising from the lateral wall of the cavernous sinus, and is the most common nonglial primary brain tumor. Cavernous sinus meningiomas may cause multiple cranial nerve palsies by invading or compressing the cavernous sinus. This is because of their close relationship to the cranial nerves II to VI, and pituitary findings. The findings are pituitary insufficiency due



E F

Fig. 2 Axial T1W (E and F) images show atrophic change of the right temporalis and masseter muscles (open white arrow), compared to the left

to invasion of the pituitary gland or compression of the gland or of the stalk if they are large enough. Schwannomas, metastases, direct invasion or perineural spread of the head and neck malignancies, and cavernous sinus invasion by pituitary adenomas, lymphomas, and granulomatous inflammations can mimic meningioma at this area[5,6].

There are case reports from various primary cancer causes such as metastatic melanoma[4], hepatocellular carcinoma[5], squamous cell carcinoma[7], and thyroid papillary adenocarcinoma[8], and also a case series for sella and parasellar metastasis[3, 9]. However, none of these reports show the comparison in imaging of the cavernous sinus metastasis to the advanced nasopharyngeal cancer.

Conclusion

Both nasopharyngeal carcinoma and cavernous sinus metastasis with inferior extension can have the same clinical presentation and imaging findings. Whenever there is a mass lesion involving both the cavernous sinus and parapharyngeal space through the foramen lacerum or foramen ovale, extension of CA nasopharynx, metastatic lesion or granulomatous inflammation should be in the differential diagnosis. A related clinical symptom and thorough image interpretation is helpful for reaching the diagnosis.

Clues in differentiating CA nasopharynx from inferior extension of cavernous sinus metastasis and also meningioma are shown in Table 1.

Table 1. Clues in differentiating CA nasopharynx from inferior extension of cavernous sinus metastasis and also meningioma

CA nasopharynx	Cavernous sinus metastasis	Cavernous sinus meningioma
Mostly originates from Rosen Muller fossa and involves the cavernous sinus in advanced cases.	Originates from the cavernous sinus.	Intact Rosen Muller fossa, may in volve eustachian tube in advanced cases.
Inhomogeneous enhancement. Presence of cervical lymphadenopathy favoured diagnosis.	Various patterns of enhancement and tissue character. Lymphdenopathy can also be seen.	Intense enhancement with sunburst pattern. Hyperostosis of the adjacent osseous structures. Positive dural tail sign.
	Primary from lung and breast are common.	

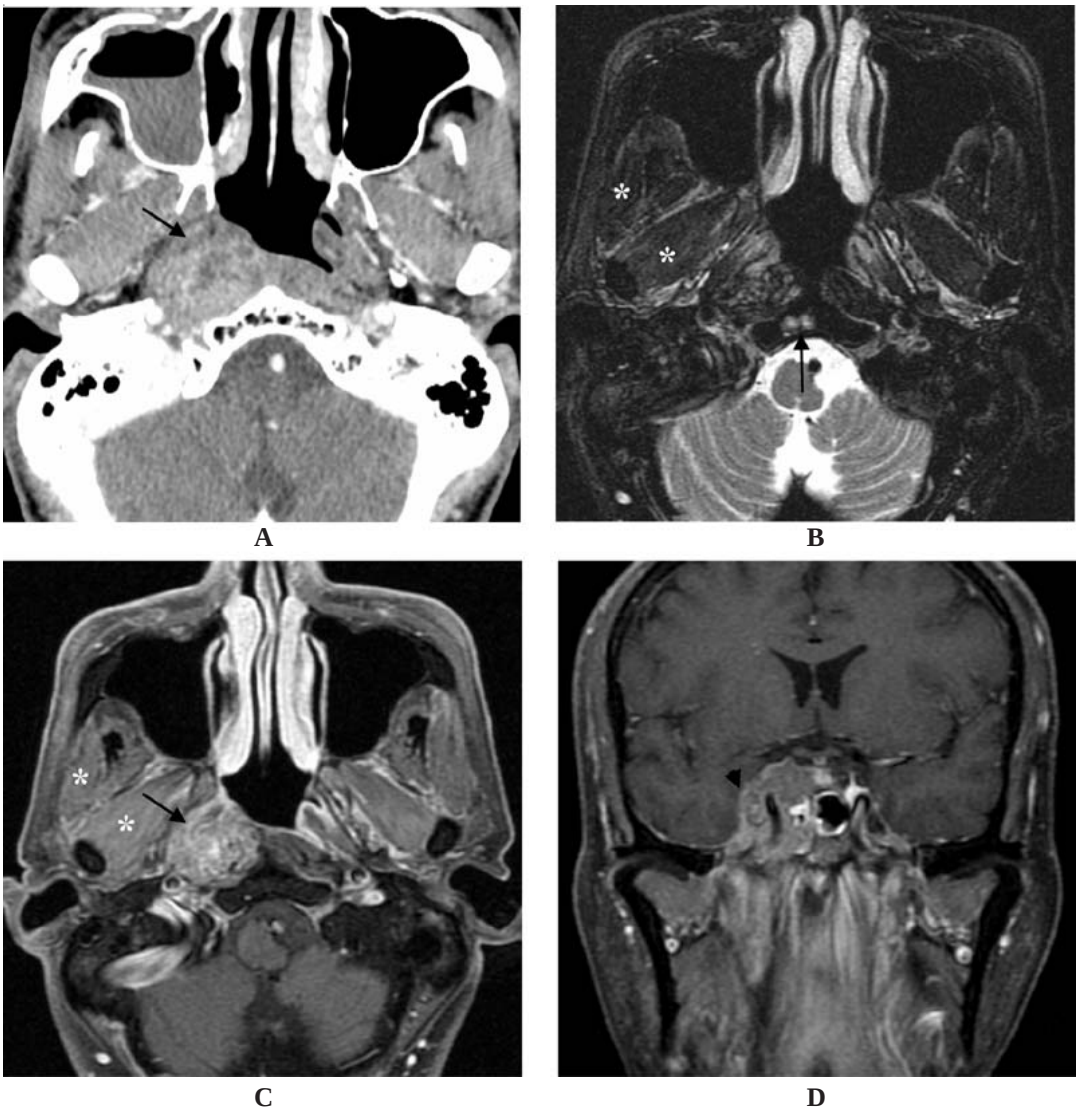


Fig. 3 A comparison case: A patient with advanced nasopharyngeal cancer, contrasted axial CT (A), axial T2W (B) and post contrast T1W with fat suppression (C) and post gadolinium coronal T1W with fat suppression (D) show tumor mass at the right Rosen muller fossa invading right sided clivus (small arrow in B). Tumor invading the right cavernous sinus is seen (arrowhead in D), with inferior extension to the infratemporal masticator space. Hypersignal T2 change and enhancement of the right muscles of mastication is seen, including massetter, lateral pterygoid, and temporalis muscles (asterisk)

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ภาพวินิจฉัยคลื่นแม่เหล็กไฟฟ้าของการแพร่กระจายของมะเร็งจาก cavernous sinus ไปด้านล่างคล้ายกับมะเร็งหลังโพรงจมูกที่แพร่ขึ้นมาด้านบน

ลออพร ภวัครานนท์, จิรพร เหล่าธรรมทัศน์

มะเร็งที่แพร่มาที่ cavernous sinus สามารถแพร่ไปด้านล่างถึงบริเวณหลังโพรงจมูก ให้ภาพวินิจฉัยคลื่นแม่เหล็กที่คล้ายกับ ภาพที่ได้จากผู้ป่วยที่เป็นมะเร็งหลังโพรงจมูกแล้วแพร่ขึ้นมาด้านบน มีข้อแตกต่างเล็กน้อยทาง imaging ที่สามารถใช้ช่วยวินิจฉัยออกจากกันได้