ORIGINAL ARTICLE

Transnasal Endoscopic Resection of a Cavernous Sinus Hemangioma: Technical Note and Review of the Literature

Justin F. Fraser, M.D.,[1] Alon Y. Mass,[2] Seth Brown, M.D.,[2] Vijay K. Anand, M.D.,[2] and Theodore H. Schwartz, M.D.[1]

ABSTRACT

Objective/Importance: Hemangiomas of the cavernous sinus are rare lesions. Complete removal through a transcranial route often causes ocular motor palsies. Because the cranial nerves in the cavernous sinus are lateral to the carotid, a medial approach to the cavernous sinus may be less traumatic to the cranial nerves. Clinical Presentation: A 50-year-old man with headaches, dizziness, diplopia, and magnetic resonance imaging that demonstrated a right cavernous sinus mass expanding into the sella and sphenoid sinus. Intervention: A gross total removal of a cavernous sinus hemangioma was performed through an extended endoscopic transsphenoidal approach. Conclusion: This is the first report of a complete removal of a cavernous sinus hemangioma using an endoscopic transnasal approach. The endoscopic transnasal approach to the medial cavernous sinus may be less traumatic than the transcranial route based on the lateral location of the cranial nerves.

KEYWORDS: Cavernous sinus hemangioma, gross total resection, transnasal, transsphenoidal, transthemoidal, endonasal surgery

Cavernous sinus hemangiomas (CSHs) are extremely rare lesions and have been reported to account for less than 2% of all cavernous sinus tumors.[1–5] The highly vascular nature of these tumors, proximity to crucial cranial nerves, and relationship to the intracavernous internal carotid artery (ICA) make them particularly difficult to surgically resect. Typically occurring in the fifth decade of life, predominantly in women, they are benign neoplasms of nonmeningeal origin. Of the 77 previously reported cases in the past 15 years of literature, 65 were treated with craniotomy, one with microscopic transsphenoidal partial resection, nine with radiosurgery, and two with endoscopic

Departments of [1]Neurological Surgery and [2]Otorhinolaryngology, Weill Medical College of Cornell University, New York–Presbyterian Hospital, New York, New York.

Address for correspondence and reprint requests: Theodore H. Schwartz, M.D., Department of Neurosurgery, Weill Cornell Medical Center, New York Presbyterian Hospital, 525 E. 68th Street, New York, NY 10021 (e-mail: schwarh@med.cornell.edu).

Skull Base 2008;18:309–315.

Received: October 19, 2007. Accepted: March 27, 2008. Published online: September 9, 2008.
DOI 10.1055/s-0028-1086059. ISSN 1531-5010.

Table 1 Summary of Published Cases Since 1992

	Source	*n*	Approach	GTR	STR	Postoperative Complications	LT Morbidity
Endoscopy	Fraser et al 2008 (current study)	1	Transsphenoidal	1 (100%)	0 (0%)	0	N/A
	Jeon et al 2004[19]	1	Transsphenoidal	0 (0%)	1 (100%)	1 (hypopituitarism)	1 (100%)
	Cobbs and Wilson 2001[17]	1	Transsphenoidal	0 (0%)	1 (100%)	1 (CSF leak)	0 (0%)
Total		3		1 (33%)	2 (67%)	2 (67%)	1 (33%)
Craniotomy	Linskey et al 1992[4]	3	Frontotemporal (OZ)	3 (100%)	0 (0%)	3 (III paresis, panhypopituitarism, VI hypesthesia/palsy)	1 (33%)
	Lee et al 1995[3]	1	Frontotemporal	0 (0%)	1 (100%)	1 (L horner/L abducens paresis)	1 (100%)
	Goel et al 1995[7]	1	Frontotemporal (OZ)	1 (100%)	0 (0%)	0	0 (0%)
	Suzuki et al 1996[14]	7	Transylvian	2 (29%)	5 (71%)	1 (oculomotor paresis)	1 (14%)
	Shi et al 1999[12]	10	Frontotemporal	4 (40%)	6 (60%)	8 (5 opthalmoplegia, III paralysis, facial numb)	4 (40%)
	Tannouri et al 2001[15]	1	Lateral wall	1 (100%)	0 (0%)	0	0 (0%)
	Goel et al 2003[2]	13	Extradural, basal temp.	12 (92%)	1 (8%)	10 (10 extraoccular movement dysfunction)	0 (0%)
	Aversa do Souto et al 2003[1]	1	Frontotemporal (OZ)	0 (0%)	1 (100%)	0 (trigeminal neuralgia not relieved)	0 (0%)
	Zhou et al 2003[16]	20	Frontotemporal (13 EDA, 7 IDA)	12 (60%)	8 (40%)	17 (16 worsened neuropathies, 1 death)	4 (20%)
	Chuang et al 2006[6]	1	Microscopic transsphenoidal	0 (0%)	1 (100%)	0	0 (0%)
	Mertol et al 2006[5]	1	Frontotemporal	1 (100%)	0 (0%)	1 (III paresis)	0 (0%)
	Suri et al 2007[13]	7	Frontotemporal osteoplastic	6 (86%)	1 (14%)	6 (transient cranial nerve dysfunction)	1 (14%)
Total		66		42 (64%)	24 (36%)	47 (71%)	12 (18%)

	Source	*n*	Approach	Dosage (Gy max)	Postoperative Complications	LT Morbidity
Radiosurgery	Kida et al 2001[10]	3	Gamma knife	27, 28, 34	0	0 (0%)
	Peker et al 2004[11]	5	Gamma knife	16	2 (III palsy)	2 (40%)
	Grosu et al 2006[8]	1	Sterotactic fractionated	40	0	0 (0%)
Total		9			2 (22%)	2 (22%)
Total		78			51 (65%)	15 (19%)

GTR, gross total resection; STR, subtotal resection; LT, long-term; CSF, cerebrospinal fluid; OZ, orbitozygomatic; temp., temperature; EDA, extradural approach; IDA, indradural approach; L, left.

transnasal resection (Table 1).[1,3–16] The previously reported endoscopic resections were subtotal.[9,17] We present a case in which a purely endosopic transnasal approach was employed and a gross total resection (GTR) achieved without new oculomotor palsies. Transnasal endosopic approaches to select pathology within the medial cavernous sinus may offer an alternative to craniotomy that places the cranial nerves at less risk.

CASE REPORT

Clinical Presentation

A 50-year-old man presented complaining of dizziness, intermittent severe headaches, and mild diplopia. He denied galactorrhea, palpitations, heat/cold intolerance, changes in visual acuity, and changes in libido, erections, or sexual habits. His neurological examination was nonfocal. Magnetic resonance imaging (MRI) read by a neuroradiologist demonstrated an expansile sella/parasellar mass that extended into the left suprasellar cistern and into the cavernous sinus, with inferior displacement of the cavernous segment of the left ICA (Fig. 1A). Endocrinologic studies were normal except for a mildly elevated prolactin level (36.6 ng/mL). Given the location and size of the mass, endoscopic transnasal resection was recommended for diagnostic, cytoreductive, and therapeutic purposes.

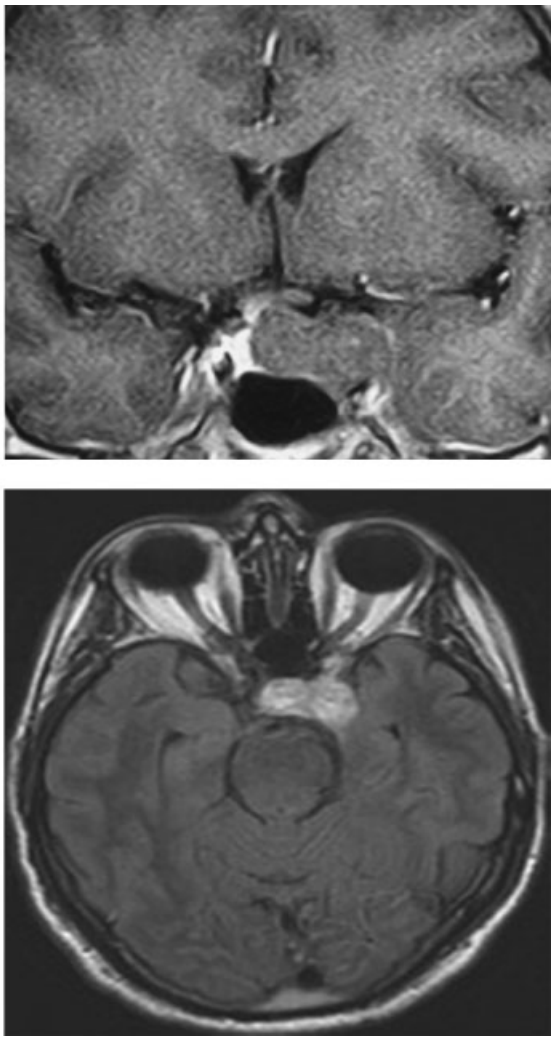

Figure 1 (A) Preoperative coronal gadolinium-enhanced magnetic resonance imaging scan demonstrates a $1.7 \times 1.6 \times 2.8$-cm mass within the lateral sella and cavernous sinus. (B) Axial fluid attenuated inversion recovery (FLAIR) postcontrast imaging demonstrates the presence of tumor in the cavernous sinus and within the sella.

Intervention and Technique

The patient was placed supine on the table and the head was placed in cranial fixation, neck slightly extended, for stereotactic navigation (BrainLab, Feldkirchen, Germany). An endonasal, transethmoidal, transsphenoidal approach to the sella and medial cavernous sinus was performed.[18–22] The bone over the anterior wall of the cavernous sinus was removed with a high-speed pneumatic diamond drill (Anspach, Palm Beach Gardens, FL) and a Kerrison rongeur. The course of the carotid artery was identified with a micro-Doppler. The dura over the sella was opened with a sickle knife and extended to the expose the medial border of the carotid artery (Fig. 2). The tumor was identified as a firm, fibrous vascular mass. The tumor was resected from within the sella and, using angled endoscopes, the internal decompression was continued into the medial cavernous sinus. Under direct visualization, the remaining

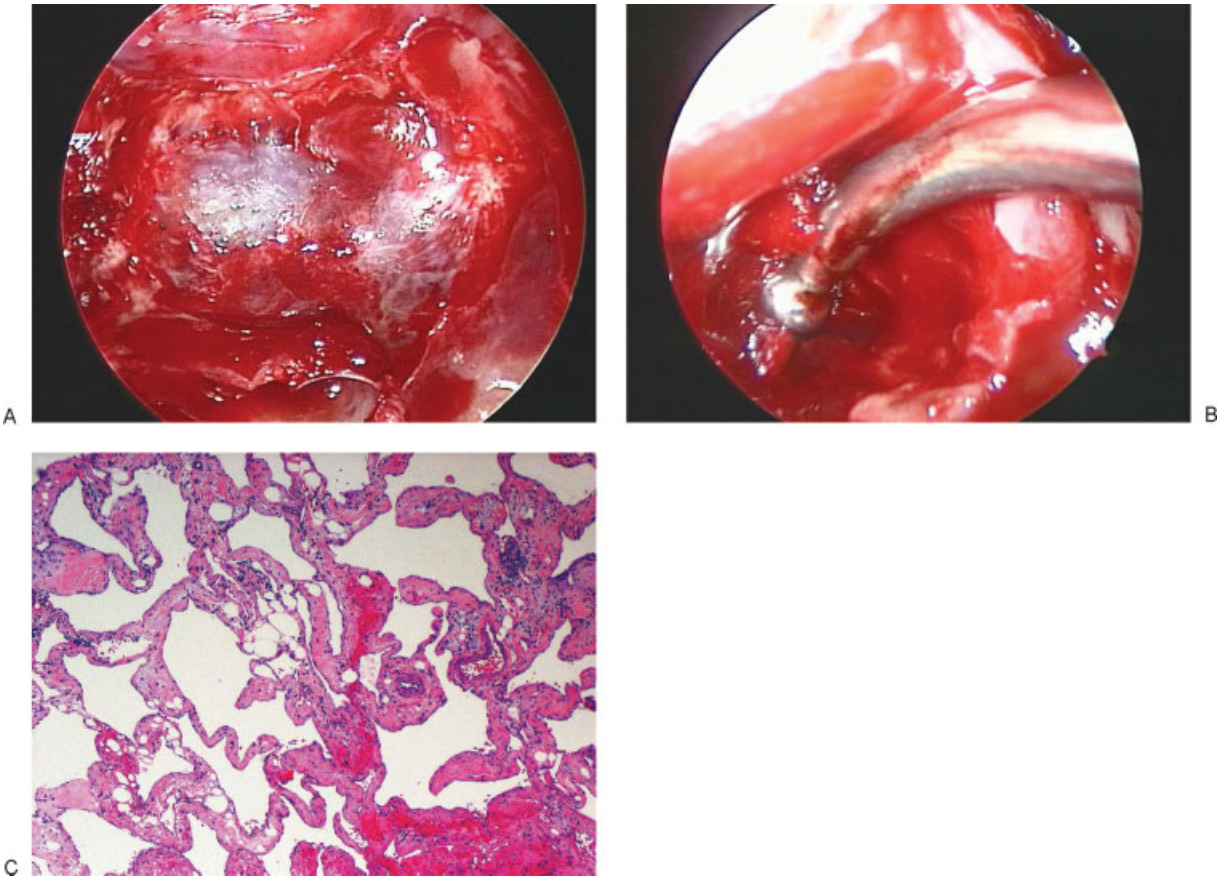

Figure 2 Intraoperative endosopic images of (A) the transethmoidal transsphenoidal approach to the cavernous sinus with bone removal exposing the dura of the cavernous sinus covering the intracavernous internal carotid artery (ICA). (B) View into medial cavernous sinus with a 45-degree endoscope after removal of the tumor reveals the course of the intracavernous ICA indicated by the tip of an angled suction. (C) Histology demonstrated back-to-back vascular spaces and blood vessels, separated by areas of spindle-cell fascicles. The spindle cells have indistinct cell borders and bland nuclei. Myxoid stromal changes were present. No increased mitotic activity or necrosis was identified. Elastin stain confirmed absence of well-formed elastic lamina, and there was a lack of epithelial membrane antigen (EMA) in the spindle cells.

rim of tumor was mobilized from the cavernous sinus, and adhesions were cut sharply with microscissors.

Adequate hemostasis from cavernous sinus bleeding was obtained using thrombin-soaked gelfoam. The sella was then covered with DuraSeal (Confluent Surgical, Inc., Waltham, MA) and the sphenoidal sinus was filled with FloSeal (Baxter, Deerfield, IL).

The patient recovered from surgery well without evidence of postoperative cranial neuropathy, pituitary dysfunction, or cerebrospinal fluid leak. Postoperative MRI was read by a neuroradiologist and demonstrated a GTR of the lesion, with no T2 fluid attenuated inversion recovery (FLAIR)-hyperintensity suggestive of residual tumor. A thin margin of postcontrast enhancement was noted to be consistent with granulation tissue (Fig. 3). Pathology demonstrated a CSH (Fig. 2C).

DISCUSSION

CSHs are benign skull base lesions that invade locally and cause symptoms primarily from local

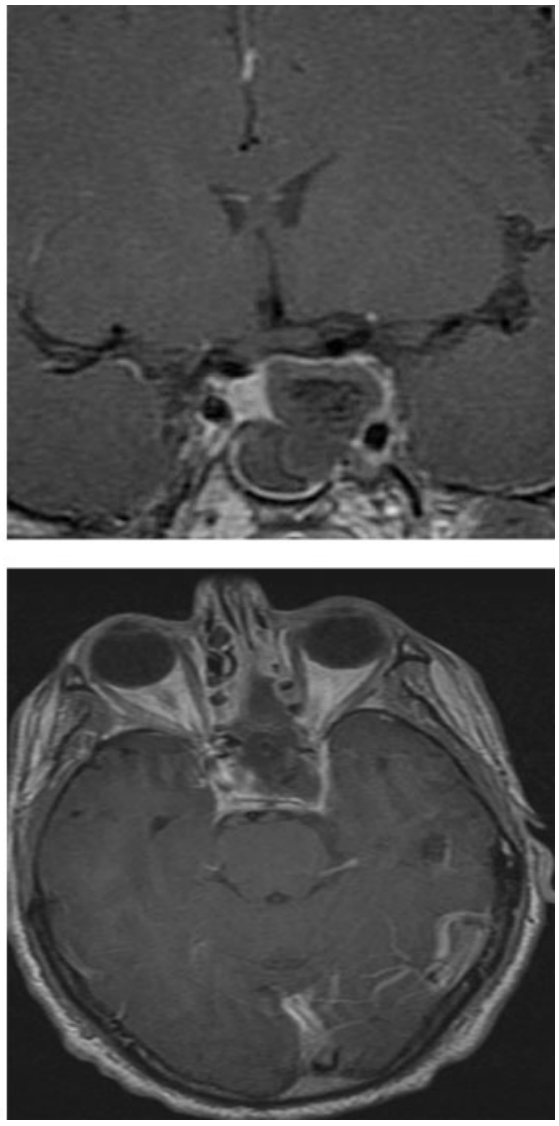

Figure 3 (A and B) Postoperative coronal and axial gadolinium enhanced magnetic resonance imaging scans demonstrate complete resection of the tumor.

mass effect. Though benign, they can be debilitating due to their location within the cavernous sinus, causing cranial nerve deficits from compression of intracavernous cranial nerves. Common clinical symptoms and signs include persistent and/or progressive ocular pain, ophthalmoparesis, and headaches.[4] Less commonly, endocrinopathies, exophthalmos, or trigeminal neuralgia may occur.[10,23,24] They can expand laterally into the middle fossa, superiorly toward the optic chiasm, and medially into the sella.[25]

A variety of treatment approaches toward CSH has been reported in the literature. Table 1 summarizes the 77 reports of CSHs that have been presented in the literature after 1990. Of them, 87% have used a frontotemporal, often orbitozygomatic, surgical approach for resection. Due to the high possibility of profuse bleeding during surgical intervention combined with potential for long-term cranial nerve deficits, some practitioners have focused upon stereotactic radiosurgery for treatment of these lesions.[8,10,11] Although radiosurgery has been shown to reduce the size of tumors, total gross resection, when safe, is preferable. Short-term complication rates after craniotomy were 72%, most often representing cranial nerve deficits, compared with 22% after radiosurgery. Overall, long-term morbidity rates were found to be 20%.

Techniques for resection of hemangiomas have been previously reported in detail.[4,16] Types of craniotomy vary by central location of the tumor and local invasion (to sella versus middle fossa). Some important surgical tenants include planning for potential transfusion and thorough understanding of the anatomic relationships within the cavernous sinus. Some have advocated proximal control of the ICA, especially if tumor resection requires significant manipulation of the vessel. This may be chiefly important in cases where the vessel is encased circumferentially. As noted by Linskey and Sekhar, CSHs typically have a pseudocapsule that, if properly dissected, will provide a plane between the tumor and surrounding cranial nerves and ICA.[4] The exception to this is the abducens nerve, which, as a result of its natural anatomy within the cavernous sinus, may course through the tumor substance proper. Thus, preoperative planning for resection, regardless of method, demands meticulous study of preoperative radiographic studies to fully understand the relationship of the tumor to these structures. This anatomy is vital, as it may guide surgical approach.

We report the first GTR of a CSH through an endoscopic transnasal approach. The anatomy of the tumor, medial in the cavernous sinus, extending

into the sella with no significant extension into the middle fossa, made this patient an appropriate candidate for transnasal endoscopic resection. The endoscopic approach permitted identification of the normal pituitary gland, the cavernous sinus, and the intracavernous ICA prior to any resection of tumor. Furthermore, it provided access to the cavernous sinus through the medial wall, which, unlike the lateral wall traversed via craniotomy, contains no cranial nerves. Endonasal endoscopic and microscopic transsphenoidal approaches to the medial cavernous sinus are well described in the literature, although mostly utilized for the resection of pituitary adenomas with intracavernous extension.[18,20–22,26–28] Although two previously reported cases of endoscopic transsphenoidal resection have been published, this case demonstrates the feasibility of a GTR. In the previously published cases by Jeon et al and by Cobbs and Wilson, the authors intentionally performed a subtotal resection, recommending that, if frozen section confirms hemangioma, the surgeon should perform only a subtotal resection because "these lesions are dural based and complete resection may result in serious bleeding."[9,17] In one case, the primary concern with the extent of resection was the tearing of arachnoid and a resultant cerebrospinal fluid leak. Based upon our experience, we would extend the application of the transnasal endoscopic approach to appropriate CSHs.[29] In particular, this approach is especially useful for cavernous hemangiomas with significant extension medially into the sella. With advances and experience in endoscopic approaches, resection nuances, angled scope tools, and skull base closure techniques, GTR of appropriately selected lesions may be safe and feasible through an endoscopic approach.

CONCLUSION

CSHs are rare benign tumors traditionally treated with an open craniotomy. Recent studies have shown some utility to radiosurgery. We report for the first time a GTR of a CSH via a purely endoscopic transnasal approach, highlighting the importance of advances in minimal access neurosurgery to the treatment of such complicated lesions of the skull base.

REFERENCES

1. Aversa do Souto A. Marcondes J, Reis da Silva M, Chimelli L. Sclerosing cavernous hemangioma in the cavernous sinus: case report. Skull Base 2003;13:93–99
2. Goel A, Muzumdar D, Sharma P. Extradural approach for cavernous hemangioma of the cavernous sinus: experience with 13 cases. Neurol Med Chir (Tokyo) 2003;43:112–118; discussion 119
3. Lee AG, Miller NR, Brazis PW, Benson ML. Cavernous sinus hemangioma. Clinical and neuroimaging features. J Neuroophthalmol 1995;15:225–229
4. Linskey ME, Sekhar LN. Cavernous sinus hemangiomas: a series, a review, and an hypothesis. Neurosurgery 1992; 30:101–108
5. Mertol T, Yuceer N. Cavernous hemangioma of the cavernous sinus: a case report. Turk Neurosurg 2006;16: 30–33
6. Chuang CC, Jung S, Yang J, Chang C, Pai P. Intrasellar cavernous hemangioma. J Clin Neurosci 2006;13:672–675
7. Goel A, Nadkarni TD. Cavernous haemangioma in the cavernous sinus. Br J Neurosurg 1995;9:77–80
8. Grosu AL, Nieder C. Stereotactic fractionated radiotherapy for recurrent capillary hemangioma of the cavernous sinus. Strahlenther Onkol 2006;182:179–182
9. Jeon S, Yi J, Yang J, Lee I. Intrasellar cavernous hemangioma. J Korean Neurosurg Soc 2004;36:163–165
10. Kida Y, Kobayashi T, Mori Y. Radiosurgery of cavernous hemangiomas in the cavernous sinus. Surg Neurol 2001;56:117–122; discussion 122–113
11. Peker S, Kilic T, Sengoz M, Pamir MN. Radiosurgical treatment of cavernous sinus cavernous haemangiomas. Acta Neurochir (Wien) 2004;146:337–341; discussion 340
12. Shi J, Wang H, Hang C, Pan Y, Liu C, Zhang Z. Cavernous hemangiomas in the cavernous sinus. Case reports. Surg Neurol 1999;52:473–478; discussion 478–479
13. Suri A, Ahmad FU, Mahapatra AK. Extradural transcavernous approach to cavernous sinus hemangiomas. Neurosurgery 2007;60:483–488; discussion 488–489
14. Suzuki Y, Shibuya M, Baskaya MK, et al. Extracerebral cavernous angiomas of the cavernous sinus in the middle fossa. Surg Neurol 1996;45:123–132
15. Tannouri F, Divano L, Caucheteur V, et al. Cavernous haemangioma in the cavernous sinus: case report and review of the literature. Neuroradiology 2001;43: 317–320
16. Zhou LF, Mao Y, Chen L. Diagnosis and surgical treatment of cavernous sinus hemangiomas: an experience of 20 cases. Surg Neurol 2003;60:31–36; discussion 36–37

17. Cobbs CS, Wilson CB. Intrasellar cavernous hemangioma. Case report. J Neurosurg 2001;94:520–522
18. Cavallo LM, Cappabianca P, Galzio R, Iaconetta G, De Diviitis E, Tschabitscher M. Endoscopic transnasal approach to the cavernous sinus versus transcranial route: anatomic study. Neurosurg 2005;56(suppl 2):379–389
19. Frank G, Pasquini E. Endoscopic endonasal approaches to the cavernous sinus: surgical approaches. Neurosurgery 2002;50:675
20. Frank G, Pasquini E. Endoscopic endonasal cavernous sinus surgery, with special reference to pituitary adenomas. Front Horm Res 2006;34:64–82
21. Jho HD, Ha HG. Endoscopic endonasal skull base surgery: part 2—the cavernous sinus. Minim Invasive Neurosurg 2004;47:9–15
22. Kassam A, Gardner P, Snyderman C, Mintz A, Carrau RL. Expanded endonasal approach: fully endoscopic, completely transnasal approach to the middle third of the clivus, petrous bone, middle cranial fossa, and infratemporal fossa. Neurosurg Focus 2005;19:E6
23. Savoiardo M, Passerini ACT. angiography, and RN scans in intracranial cavernous hemangiomas. Neuroradiology 1978;16:256–260
24. Tsuiki K, Abe S, Chiba M, Murakami H, Saiki I, Kanaya H. [A case of cavernous angioma of the middle cranial fossa originating in the cavernous sinus with hyperprolactinemia]. No Shinkei Geka 1987;15:301–305
25. Gonzalez LF, Lekovic GP, Eschbacher J, Coons S, Porter RW, Spetzler RF. Are cavernous sinus hemangiomas and cavernous malformations different entities? Neurosurg Focus 2006;21:e6
26. Anand V, Schwartz T. Surgical approaches to the anterior skull base. In: Anand V, Schwartz T, eds. Practical Endoscopic Skull Base Surgery. San Diego, CA: Plural Publishing; 2007:71–88
27. Cappabianca P, Cavallo L, Esposito F, De Divitiis E. Endonasal approaches to the cavernous sinus. In: Anand V, Schwartz T, eds. Practical Endoscopic Skull Base Surgery. San Diego, CA: Plural Publishing; 2007:177–190
28. Couldwell WT, Weiss MH, Rabb C, Liu JK, Apfelbaum RI, Fukushima T. Variations on the standard transsphenoidal approach to the sellar region, with emphasis on the extended approaches and parasellar approaches: surgical experience in 105 cases. Neurosurgery 2004;55:539–547
29. Schwartz TH, Fraser JF, Brown S, Tabaee A, Kacker A, Anand VK. Endoscoptic cranial base surgery: classification of operative approaches. Neurosurgery 2008;62:991–1002