Technical Note

Intraventricular trigonal meningioma: Neuronavigation? No, thanks!

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Abstract

Background: Most of the time meningiomas are benign brain tumors and surgical removal ensures cure in the vast majority of the cases. Thus, whenever possible, complete surgical resection should be the goal of the treatment.

Methods: This is a report of our surgical technique for the operative resection of a trigonal meningioma in a resource-limited setting. The necessity of accurate and deep knowledge of the regional anatomy is outlined.

Results: A 44-year-old male presented to our outpatient clinic complaining of cephalalgia increasing in frequency and intensity over the last month. His neurological exam was normal, yet a brain computed tomography scan revealed a lesion in the right trigone of the ventricular system. The diagnosis of possible meningioma was set. After thoroughly informing the patient, tumor resection was decided. An intraparietal sulcus approach was favored without the use of any modern technological aids such as intraoperative magnetic resonance imaging or neuronavigation. The postoperative course was uneventful and a postoperative computed tomography scan demonstrated the complete resection of the tumor. The patient was discharged two days later with no neurological deficits. In a two-year-follow-up he remains recurrence-free.

Conclusion: In the current cost-effective era it is still possible to safely remove an intraventricular trigonal meningioma without the convenience of neuronavigation. Since the best neuronavigator is the profound neuroanatomical knowledge, no technological advancement could replace a well-educated and trained neurosurgeon.

Key Words: Neuronavigation, surgical resection, trigonal meningioma

INTRODUCTION

Even though it has been almost a century since the first meningioma was radically removed from the lateral ventricle by Cushing, the surgical management of these tumors still remains a challenging task. Intraventricular meningiomas as a rule arise in the trigone and several surgical
approaches to this region have been meticulously described.\textsuperscript{(7-9,12,15,17,20,22,23,28,30,33,38,41-44,46,49,53,54,57,58,60,61)} For these lesions, many neurosurgeons currently employ new technological adjuncts intraoperatively, and neuronavigation is one of them.\textsuperscript{(54)} At the same time, there are many resource-limited Neurosurgical Departments globally (and the authors’ Department is certainly not excluded) that strive to treat a vast variety of lesions without having access to such sophisticated tools.

Hereby, the authors present the excellent surgical outcome of a patient presenting with a right trigonal meningioma (TM) using the intraparietal sulcus approach. The meningioma was excised without the aid of a neuronavigational system. It is the authors’ belief that such lesions can be safely treated if a profound knowledge of the regional surgical anatomy is acquired even in the current era of healthcare budget cuts.

**CLINICAL AND SURGICAL DESCRIPTION OF THE CASE**

A 44-year-old male had a history of intermittent mild headaches for a period of two years. The symptom had been increasing in frequency and intensity during the last month prior to the medical consultation. The neurological exam failed to detect any abnormality. Visual function was intact. The history revealed no other pathology. A brain computed tomography (CT) scan with contrast medium was obtained demonstrating a hyperdense lesion with homogenous contrast enhancement located at the right trigone of the lateral ventricle [Figure 1]. The lesion was compatible with a TM.

**Surgical technique**

After obtaining an informed consent, the patient was taken to the operating room. Due to the tumor’s location, the authors opted for an intraparietal sulcus approach. An enlarged trigone due to a 32 cm\(^2\) tumor favored the option for this approach, making the distance from the cerebral sulci to the trigone shorter than the usual. No lumbar spinal drainage was performed preoperatively.\textsuperscript{(54)}

The patient was placed in an elevated supine position, with the head in a neutral position, maintained by a three-point fixation device and slightly flexed under general endotracheal anesthesia. A “C”-shaped right parietal skin incision was made verifying that the Keen’s point (found 3 cm above and 3 cm behind the external auditory meatus) was at the centrum of the craniotomy [Figure 2a]. A paramedian rectangular craniotomy was then performed using four burr holes and extending 6 cm laterally to the sagittal suture and 8 cm anterior to the lambdoid suture in order to expose the parietal lobe without extending beyond the superior sagittal sinus [Figure 2b].

The dura was opened in a horseshoe fashion so that
the superior sagittal sinus could be easily located and protected. Since the intraparietal sulcus is the only sulcus that usually runs almost parallel and 3 cm lateral to the midline in this area dividing the parietal lobe in the superior and inferior parietal lobules, it's identification was not laborious [Figure 2c]. After having identified the intraparietal sulcus, careful microsurgical techniques were employed to reach the bottom of the sulcus [Figure 2d]. This corresponds to the roof of the atrium which is free of optic radiations and is formed by the body, splenium and tapetum of the corpus callosum. Of note, the optic radiations are separated from the lateral wall of the atrium by tapetum fibers. Consequently, it is imperative to maintain a straight course during dissection, from the cerebral surface to the roof of the atrium, in order to preserve the optic radiations located laterally.

The authors were able to perform an “en bloc” resection of the tumor with preservation of the neuroanatomical structures [Figure 2e]. No brain retractors were used. The macroscopic aspect of the tumor was compatible with meningioma [Figure 2f]. Standard hemostasis was achieved with electrocautery and oxidized cellulose (Surgicel®, Ethicon, Inc., Somerville, NJ, USA). The dura mater was closed in a watertight manner. The bone flap was repositioned and fixed to the bone with silk sutures.

The histopathologic findings were consistent with meningothelial meningioma (Grade I, 2007 WHO classification). A photomicrograph showing the tumor specimen could not be retrieved. The postoperative course was uneventful and a new postoperative head CT scan was asked that documented no residual tumor [Figure 3]. The patient left the hospital two days later, being neurologically intact. Two years after the operation, he is still being followed up in the outpatient clinic and he is recurrence-free.

**DISCUSSION**

This technical note presents the favorable surgical outcome of a patient harboring a right TM using an intraparietal sulcus approach. Due to limited financial support, our Department lacks many modern tools such as neuronavigational systems, tractography, titanium plates, such as Craniofix® plates (Aesculap AG, Tuttingen, Germany), potassium titanyl phosphate lasers, and endoscopic adjuncts to intraventricular surgery. The operation was pulled off based solely on the adequate knowledge of the anatomical elements that surround this kind of lesions.

In adults, meningiomas comprise about 14-20% of all brain tumors while only 1-4.2% of all primary pediatric intracranial tumors are meningiomas. Intraventricular meningiomas are responsible for only 0.5–5% of all adult meningiomas series. An intraventricular location is found in 9.4-20% of children. The majority of intraventricular meningiomas are located in the lateral ventricles, 90% of them occurring in the trigone. They show a predilection for the left side, even though many TM have been described on the right side too. They are more common in females, while male patients have also been documented. The age at diagnosis ranges from 22 to 75 years.

TM seem to originate from the arachnoidea of the choroid plexus and the tela chooroidea. The histological diagnosis includes many types, namely fibroblastic (which is the predominant one), meningothelial, transitional, lymphoplasmacytic metaplastic, psammomatous, atypical, and rhabdoid-papillary. Malignant meningiomas could metastasize to the spine through the cerebrospinal fluid (CSF) but extraneural metastases (liver) are also possible. In addition, transitional meningiomas can progress to anaplastic meningiomas and metastasize via the CSF. An encapsulated by dura-like membrane TM has also been reported.

A group of entities mimicking TM includes choroid plexus metastases of renal cell carcinoma with or without intraventricular hemorrhage, glioblastoma multiforme, and cavernous malformations.

TM could be an incidental finding When symptoms are present, the most common ones are related to the gradual increase of intracranial pressure rather than the location of the tumor, and they are usually delayed because TM usually do not obstruct the CSF pathway. Actually, TM may be very large at diagnosis and the principal symptoms and signs are motor, sensory and cognitive disturbances, as well as visual field deficits.
Symptoms frequently encountered include: fatigue, cephalalgia, nausea, dizziness, vomiting, impairment of vision, apathy, epileptic attacks, speech difficulty, numbness of lower extremities. In fact, the transcallosal approach was favored by the anterior choroidal artery (nondominant hemisphere). [7,10,22,28,35,41,42,44,47,53,54] The morbidity related to lateral access to the trigone includes language deficits, ideomotor apraxia, acalculia (dominant hemisphere), visual fields disturbances (quadranopsia), and impaired recognition of emotions (dominant hemisphere). [5,31,42,60] Yet, an approach inferior to the inferior temporal sulcus seems to avoid traversing through the optic radiations. [43] The authors avoid lateral approaches because magnetic resonance tractography and awake brain mapping surgery require funds that are currently unavailable.

In the superior parietal approach, which is commonly used, an incision is made in the superior parietal gyrus to access the medial and lateral regions of the trigone. [7,15,28,41,42,49,53,57,58,60] This approach provides a direct route to the atrium but some complications such as apraxia, acalculia, and homonymous hemianopia have been described. [31,42,49,60] The authors do not favor this approach in order to avoid cortical incisions. It is their belief that it can increase the risk of epileptic seizures, although a large series comparing transcortical and transcallosal approaches for intraventricular tumors failed to validate this assumption. [37] In fact, the transcallosal approach was associated with a higher risk of postoperative seizures. [37]

The lateral approaches involve incisions on the posterior aspect of the medial or inferior temporal gyrus and on the temporoparietal junction. [9,10,12,22,28,35,41,44,46,49,57,58,61] The morbidity related to lateral access to the trigone includes language deficits, ideomotor apraxia, acalculia (dominant hemisphere), visual fields disturbances (quadranopsia), and impaired recognition of emotions (nondominant hemisphere). [5,31,42,60] Yet, an approach inferior to the inferior temporal sulcus seems to avoid traversing through the optic radiations. [43] The authors avoid lateral approaches because magnetic resonance tractography and awake brain mapping surgery require funds that are currently unavailable.

The posterior transcallosal approach does not affect the optic radiations but it is associated with auditory and
visual disconnection syndromes resulting from posterior callosotomy.\[10,20,22,28,30,41,49,57,58,60\]

Another commonly used approach is the parieto-opercular heteroemispheric approach (or occipital transcingulate approach) described by Yasargil.\[10,11,22,33,44,49,57,59,60\] This approach does not transect the corpus callosum, does not damage the optic radiations and is not associated with language deficits, once it does not violate the eloquent language cortex.\[13,49,60\] Nonetheless, postoperative recent memory disturbance has been documented.\[54\]

An anatomical advantage of this approach is the parallel course of the parieto-opercular ascending draining veins before joining the sinus which provide a free corridor toward the splenium and the posterior callosal and dorsal mesencephalic cisterns.\[60\] In the authors’ opinion, this approach presents two disadvantages. The first one is the sitting position required to perform this approach and its possible complications. The second is the need of brain retractors to gain an adequate surgical corridor.

A contralateral transfalx approach has also been described recently as an alternative approach.\[57\] It provides access to the contralateral atrium by cutting the falx while at the same time avoids damage to the visual cortex, splenium, and optic radiation. Moreover, the atrium is exposed with a wider surgical angle compared with the conventional homolateral posterior interhemispheric transprecuneus gyrus approach.\[33\] However, some drawbacks that should be mentioned are: the retraction of the contralateral occipital lobe, the potential injury of the visual pathways homolaterally, endangering the integrity of the venous sinuses by cutting the falx, and the disadvantages of the semi-sitting position.\[13,57\]

A few neurosurgeons prefer the supracerebellar infratentorial approach. This one provides access to the inferior part of the atrium by sectioning the occipitotemporal gyrus or the collateral sulcus on the inferior surface of the temporal lobe.\[57\]

Another approach proposed is the supracerebellar transcerebellar transcollateral sulcus one for access to the medioposterior aspect of the atrium by cutting the tentorium cerebelli.\[17\] No damage to optic radiation fibers is caused but there is a potential risk of injuring the veins.\[17\] Air embolism and transient deafness may also follow this approach.\[17,22\]

Irrespective of the neurosurgeon’s approach preference,\[1,14\] TM can be permanently cured with complete removal.\[1,3,7,12,14,34,42,58\] And is neuronavigation really absolutely necessary for treating them? No. As almost all older colleagues used to say, the best neuronavigator is the deep knowledge of surgical anatomy.\[74,49\] Neuronavigation systems could and do assist neurosurgeons in treating deep-seated lesions but by no means should their absence prevent us from acquiring a secure surgical outcome.

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**EPILOGUE**

The take-home message that should be imprinted in one’s mind is that Neurosurgery cannot be practiced rationally without profound knowledge of neuroanatomy. A sound understanding of tracts and other vital structures could render (at least in part) modern technological amenities less necessary. Lack of availability of neuronavigation in the case presented was not an obstacle for safely removing a TM through the intraparietal sulcus approach.

**REFERENCES**

1. Anderson RC, Ghatan S, Feldstein NA. Surgical approaches to tumors of the lateral ventricle. Neurosurg Clin N Am 2003;14:509-25.
2. Bertalanffy A, Roessler K, Kaperek Q, Gelpi E, Prayer D, Neuner M, et al. Intraventricular meningiomas:A report of 16 cases. Neurosurg Rev 2006:29:30-5.
3. Bhatoe HS, Singh P, Dutta V. Intraventricular meningiomas: A clinicopathological study and review. Neurosurg Focus 2006:20:69.
4. Bret P, Gharbi S, Cohadon F, Remond J. Meningioma of the lateral ventricle. 3 recent cases. Neurochirurgie 1989;35:5-12.
5. Criscuolo GR, Symon L. Intraventricular meningioma. A review of 10 cases of the National Hospital, Queen Square (1974-1985) with reference to the literature. Acta Neurochir (Wien) 1986;81:83-91.
6. Curry WT Jr. Cosgrove GR, Buchbinder BR, Ojemann RG. Resection of a dominant-hemisphere intraventricular meningioma facilitated by functional magnetic resonance imaging, Case report. Neurosurg Focus 2001;10:E1.
7. Deffee R, Acqui M, Oppido PA, Capone R, Santoro A, Ferrante L. Tumors of the lateral ventricles. Neurosurg Rev 1991;14:127-33.
8. Eom KS, Kim DW, Kim TY. Diffuse craniospinal metastases of intraventricular rhadoid papillary meningioma with glial fibrillary acidic protein expression: A case report. Clin Neurol Neurosurg 2009;111:619-23.
9. Eom KS, Kim HS, Kim TY, Kim JM. Intraventricular malignant meningioma with CSF-disseminated spinal metastasis: Case report and literature review. J Korean Neurosurg Soc 2009;45:236-9.
10. Erman T, Gökçer Aİ, Erdogan S, Boyar B, Hacayuk speculate S, Zorludemir S. Intraventricular meningiomas: A review of the literature and report of 8 cases. Neurosurg Q 2004;14:54-60.
11. Garcia-Conde M, Roilán-Delgado H, Martel-Barth-Hansen D, Manzano-Sanz C. Anaplastic transformation of an atypical intraventricular meningioma with metastases to the liver: Case report. Neurocirugia (Astur) 2009;20:541-9.
12. Gelsbert-González M, García-Allué A, Bandín-Díéquez J, Serramito-García R, Martínez-Rumbo R. Meningiomas of the lateral ventricles. A review of 10 cases. Neurocirugía (Astur) 2008;19:427-33.
13. Heros RC. Contralateral approach to the atrium of the lateral ventricle. J Neurosurg 2010;113:947-8.
14. Hussein S. Operative management of trigono-atrial lesions. Zentralbl Neurochir 1998;59:243-51.
15. Imielinski BL, Kloc W. Meningiomas of the lateral ventricles of the brain. Zentralbl Neurochir 1997;58:177-82.
16. Iwatsuki K, Sato M, Taguchi J, Fukui T, Kiyohara H, Yoshimine T, et al. Choroidplexus metastasis of renal cell carcinoma causing intraventricular hemorrhage: A case report. No Shinkei Geka 1999;27:359-63.
17. Izi Y, Seçkin H, Ates O, Baskaya MK. Supracerebellar transtentorial transcerebellar transcollateral sulcus approach to the atrium of the lateral ventricle: Microsurgical anatomy and surgical technique in cadaveric dissections. Surg Neurol 2009;72:509-14.
18. Jelinek J, Smirniotopoulos JG, Parisi JE, Kanzer M. Lateral ventricular neoplasms of the brain: Differential diagnosis based on clinical, CT, and MR findings. AJR Am J Roentgenol 1990;155:365-72.
19. Jin SC, AHN JS, Kwun BD, Kwon do H. Intraventricular cavernous malformation radiologically mimicking meningioma. J Korean Neurosurg Soc 2008;44:345-7.
20. Jun CL, Nutik SL. Surgical approaches to intraventricular meningiomas of the trigone. Neurosurgery 1985;16:416-20.
21. Kamija K, Inagawa T, Nagasaki R. Malignant intraventricular meningioma with spinal metastasis through the cerebrospinal fluid. Surg Neurol 1989;32:213-8.

22. Kawashima M, Li X, Rhoton AL Jr, Lin AJ, Oka H, Fuji K. Surgical approaches to the atrium of the lateral ventricle: Microsurgical anatomy. Surg Neurol 2006;65:436-45.

23. Kempe LG, Blaylock R. Lateral-trigonal intraventricular tumors. A new operative approach. Acta Neurochir (Wien) 1976;35:233-42.

24. Killebrew K, Krigman M, Mahaley MS Jr, Scatliff JH. Metastatic renal cell carcinoma mimicking a meningioma. Neurosurgery 1983;13:430-4.

25. Kleinschmidt-DeMasters BK, Avakian JJ. Wallenberg syndrome caused by CSF metastasis from malignant intraventricular meningioma. Clin Neuropathol 1985;4:214-9.

26. Kumar GS, Poonoosoo SI, Chacko AG, Rajeshkar V. Trigonal cavernous angiomas: Report of three cases and review of the literature. Surg Neurol 2006;65:367-71.

27. Kunwar S. Endoscopic adjuncts to intraventricular surgery. Neurosurg Clin N Am 2003;14:547-57.

28. Le Gars D, Lejeune JP, Pelteir J. Surgical anatomy and surgical approaches to the lateral ventricles. Adv Tech Stand Neurol 2009;34:147-87.

29. Lee EJ, Choi KH, Kang SW, Lee IW. Intraventricular hemorrhage caused by lateral ventricular meningioma: A case report. Korean J Radiol 2001;2:105-7.

30. Levin HS, Rose JE. Alexia without agraphia in a musician after transcallosal removal of a left intraventricular meningioma. Neurosurgery 1979;4:168-74.

31. Li XZ, Zhao JZ. Operation of lateral ventricular meningiomas of the trigone. Zhonghua Yi Xue Za Zhi 2006;86:2321-3.

32. Lunardi P, Conti C, Corinaldesi R, Ghetti G. An unusual growth of an intraventricular meningioma: A case report. Neurol Sci 2011;32:669-71.

33. Mahaney KB, Abdulrauf SI. Anatomic relationship of the optic radiations to the atrium of the lateral ventricle: Description of a novel entry point to the trigone. Neurosurgery 2008;63 Suppl 2:ONS195-203.

34. McDermott MW. Intraventricular meningiomas. Neurosurg Clin N Am 2003;14:559-69.

35. Majos C, Cucurella G, Aguilera C, Coll S, Pons LC. Intraventricular meningiomas: MR Imaging and MR spectroscopic findings in two cases. AJNR Am J Neuroradiol 1999;20:882-5.

36. Menon G, Nair S, Sudhir J, Rao R, Easwer HV, Krishnakumar K. Meningiomas of the lateral ventricles. Adv Tech Stand Neurosurg 2009;34:147-87.

37. Menon G, Nair S, Sudhir J, Rao R, Easwer HV, Krishnakumar K. Meningiomas of the lateral ventricles. Adv Tech Stand Neurosurg 2009;34:147-87.

38. Menon G, Nair S, Sudhir J, Rao R, Easwer HV, Krishnakumar K. Meningiomas of the lateral ventricles. Adv Tech Stand Neurosurg 2009;34:147-87.

39. Menon G, Nair S, Sudhir J, Rao R, Easwer HV, Krishnakumar K. Meningiomas of the lateral ventricles. Adv Tech Stand Neurosurg 2009;34:147-87.

40. Menon G, Nair S, Sudhir J, Rao R, Easwer HV, Krishnakumar K. Meningiomas of the lateral ventricles. Adv Tech Stand Neurosurg 2009;34:147-87.

41. Nakamura M, Roser F, Bundschuh O, Vorkapic P, Samii M. Intraventricular meningiomas: A review of 16 cases with reference to the literature. Surg Neurol 2003;59:491-503.

42. Nayar VV, DeMonte F, Yoshor D, Blacklock JB, Sawaya R. Surgical approaches to meningiomas of the lateral ventricles. Clin Neurol Neurosurg 2010;112:400-5.

43. Nayar VV, Foroozani R, Weinberg JS, Yoshor D. Preservation of visual fields with the inferior temporal gyrus approach to the atrium. J Neurosurg 2009;110:740-3.

44. Nishizaki T, Ikeda N, Nakano S, Okamura T, Akibio S. Occipital inter-hemispheric approach for lateral ventricular trigone meningioma. Acta Neurochir (Wien) 2009;151:1717-21.

45. Quinones-Hinojosa A, Chang EF, Khan SA, Lawton MT, McDermott MW. Renal cell carcinoma metastatic to the choroid plexus of intraventricular meningioma. Can J Neurol Sci 2004;31:115-20.

46. Ono K, Hashida J, Minamimura K, Ohara I, Wada K. Delayed enlargement of brain edema after resection of intracranial meningioma: Two case reports. Neurol Med Chir (Tokyo) 2009;49:478-81.

47. Oyama H, Noda S, Negoro M, Kinomoto T, Miyachi S, Kuwakawa N, et al. Giant meningioma fed by the anterior choroidal artery: Successful removal following embolization-case report. Neurol Med Chir (Tokyo) 1992;32:839-41.

48. Regel JP, Schoch B, Sandalcioglu IE, Wieland R, Westermeier C, Stolke D, et al. Malignant meningioma as a second malignancy after therapy for acute lymphocytic leukemia without cranial radiation. Childs Nerv Syst 2006;22:172-5.

49. Rowe R. Surgical approaches to the Trigone. Contemp Neurol 2005;27:1-6.

50. Shinoura N, Suzuki Y, Yamada R, Tabei Y, Saito K, Yagi K. Relationships between brain tumor and optic tract or calcarine fissure are involved in visual field deficits after surgery for brain tumor. Acta Neurochir (Wien) 2010;152:637-42.

51. Shintaku M, Hashimoto K, Okamoto S. Intraventricular meningioma with anaplastic transformation and metastasis via the cerebrospinal fluid. Neuropsychology 2007;27:448-52.

52. Silver AJ, Gani SS, Halil SK. Computed tomography of tumors involving the atria of the lateral ventricles. Radiology 1982;145:71-8.

53. Takara K, Cho K, Mori K, Maeda M. Intraventricular cystic, atypical meningioma. Neurol Med Chir (Tokyo) 1997;37:856-60.

54. Tokunaga K, Tamiya T, Date I. Transient memory disturbance after removal of an intraventricular trigonal meningioma by a parieto-occipital interhemispheric precuneous approach: Case report. Surg Neurol 2006;65:167-9.

55. Vuckovic N, Kozic DV, Vulekovic P, Vukovic D, Ostojic J, Semic R, MR and MRS characteristics of intraventricular meningioma. J Neuroimaging 2010;20:294-6.

56. Wang AM, Power TC, Rumbaugh CL. Lateral ventricular meningioma. Comput Radiol 1985;9:355-8.

57. Wang S, Salma A, Ammari M. Posterior interhemispheric transfalcine transprecuneus approach to the atrium of the lateral ventricle: A cadaveric study. J Neurol Surg 2010;71:949-54.

58. Wang X, Cai BW, You C, He M. Microsurgical management of lateral ventricular meningiomas: A report of 51 cases. Minim Invasive Neurosurg 2007;50:346-9.

59. Wen HT, Mussi AC, Rhoton AL Jr, de Oliveira E, Tedeschi H. Surgical Approaches to Lesions Located in the Lateral, Third, and Fourth Ventricles. In: Sekhar LN, Fessler RG, editors. Atlas of Neurosurgical Techniques–Brain. 1st ed. New York: Thieme Medical Publishers Inc.; 2006. p. 507-48.

60. Yasargil MG, Abdulrauf SI. Surgery of intraventricular tumors. Neurosurgery 2008;62 Suppl 6:1029-40.

61. Yoshida K, Onozuka S, Kawase T, Ikeda E. Lateral ventricular meningioma encapsulated by the dura-like membrane. Neuropathology 2000;20:56-9.