



Technical Note

Occipital interhemispheric transtentorial approach to the superior cerebellum

Raul J. Cardenas, Vijayakumar Javalkar, Haim Ezer, Jeremy Burnham, Anil Nanda*

Department of Neurosurgery Louisiana State University Health Sciences Center – Shreveport, 1501 Kings Highway, Shreveport, Louisiana 71103, USA

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ABSTRACT

The occipital interhemispheric transtentorial approach is commonly used for pineal region tumors. However, there are few reports of this approach for lesions in the superior cerebellum. We present a 47-year-old male patient with an incidental cystic lesion in the superior cerebellum, detected on MRI consistent with cerebellar hemangioblastoma. The patient initially underwent stereotactic radiosurgery. After 5 months he presented with dizziness. A repeat MRI scan revealed an interval increase in lesion size. We performed surgery using the occipital interhemispheric transtentorial approach to remove the lesion. There were no intraoperative complications and the patient tolerated the procedure well. We describe our approach, supplemented by a short video, and review operative approaches to the superior cerebellum.

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1. Introduction

Multiple surgical approaches are commonly used to provide access to the superior cerebellum, including the subtemporal transtentorial, occipital interhemispheric transtentorial and the suboccipital supracerebellar approaches.^{1–3} The choice of approach depends mainly on the location and extent of the target lesion and the preferences of the individual surgeon. In general, the supracerebellar infratentorial approach is used more frequently in patients with cerebellar hemangioblastomas² and is also used to access the pineal region.⁴ Very few studies have described the use of the occipital interhemispheric transtentorial approach for accessing cerebellar lesions.

2. Clinical presentation

A 47-year-old male was incidentally reported to have a cerebellar lesion on an MRI (Fig. 1A–C). Imaging characteristics were consistent with the diagnosis of hemangioblastoma. The patient was asymptomatic and was neurologically intact. Initially he underwent stereotactic radiosurgery. After 5 months, he presented with dizziness. Although no neurological deficits were observed, a repeat cranial MRI scan revealed an increase in size of the cystic lesion with mass effect (Fig. 1D–F). After discussing the available treatments, the patient opted for surgical excision.

3. Operative procedure

3.1. Positioning

The patient was placed in the lateral position and a lumbar drain was placed and secured. The head was turned 30° towards the floor (which placed the access side in the dependent position), to allow the occipital lobe to fall inferiorly, thereby minimizing retraction. After placement of the head in a 3-point fixation head-holder and subsequent fixation to the bed, registration using fiducial markers on a stereotactic neuronavigation system was performed.

3.2. Incision and exposure

A stereotactic neuronavigation system was used to plan the optimal skin incision in relation to the underlying superior sagittal sinus, as well as to determine the optimal trajectory (avoiding apparent bridging veins and affording the shortest distance to the lesion). A horseshoe-shaped incision was made on the side of the craniotomy in the occipital region. The base of the skin flap was along the superior nuchal line, and the medial limb was just past the midline. The skin flap was elevated along with the galea and pericranium, and reflected inferiorly. At this time, we usually ask the anesthetist to start draining cerebrospinal fluid from the lumbar drain. A single burr hole was made near the midline, and a rectangular bone flap (about 5 cm by 3 cm at midline) was elevated. The edge of the superior sagittal sinus was barely visualized. The dural flap was cut utilizing the entire space of the craniotomy, and the flaps were based towards the sinus. Utmost care was taken

* Corresponding author. Tel.: +1 318 675 6404; fax: +1 318 675 7111.
E-mail address: ananda@lsuhsc.edu (A. Nanda).

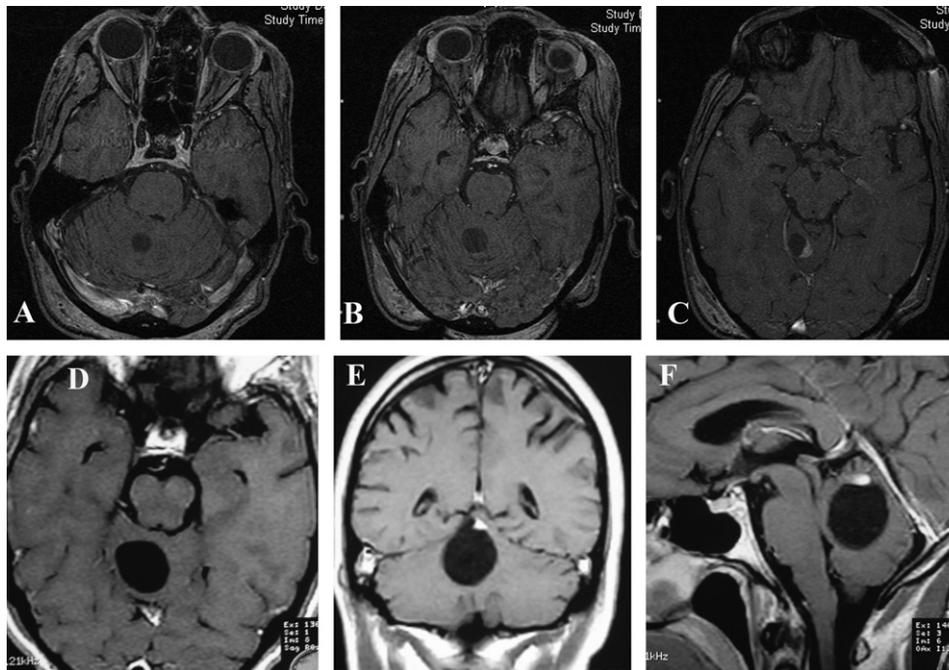


Fig. 1. Post contrast T1-weighted MRI: (A–C, axial) before gamma knife radiosurgery (GKRS); and (D, E axial; F, sagittal) 1 year after GKRS showing enlargement of the cyst.

to avoid damage to the sinus; in our experience, bridging veins are scarce in this region, and those present are easily avoidable. Having the occipital lobe in a dependent position facilitated a surgical corridor. Once the sagittal sinus was identified, the dura and the occipital hemisphere were gently retracted, hinged on the sinus. Using the frameless stereotactic system, the trajectory towards the tentorium was mapped. The trajectory was perpendicular to the cerebellar surface (Fig. 2). Approximately 2 cm of the tentorium was divided, exposing the superior aspect of the cerebellum and the cyst. After a small opening was made in the cyst, the mural nodule of the hemangioblastoma was resected under the microscope and a gross total resection was achieved (Supplementary Video 1).

4. Results

Histopathology confirmed the lesion to be a hemangioblastoma (Supplementary Fig. 1). There were no intraoperative complications and the patient tolerated the procedure well. Postoperative scans showed total excision of the hemangioblastoma (Fig. 3).

5. Discussion

The occipital interhemispheric transtentorial approach seems to have great advantages when accessing the cerebellum. These include a wide surgical field, a good angle of vision, a perpendicular surgical route to the cerebellar surface, and easy access to the lesion.⁵ Various surgical approaches to the superior part of the cerebellum have been described. These include the suboccipital and supracerebellar infratentorial approaches. Although the suboccipital approach provides wide exposure, its disadvantages include splitting or retraction of the vermis associated with truncal ataxia.⁶ Moreover, cerebellar mutism is also a complication associated with compression of the cerebellar peduncle and the dentate nucleus.^{7–9} Intraoperatively, a significant disadvantage of the suboccipital approach is that arterial feeders cannot be cauterized until the end of the tumor removal.¹⁰

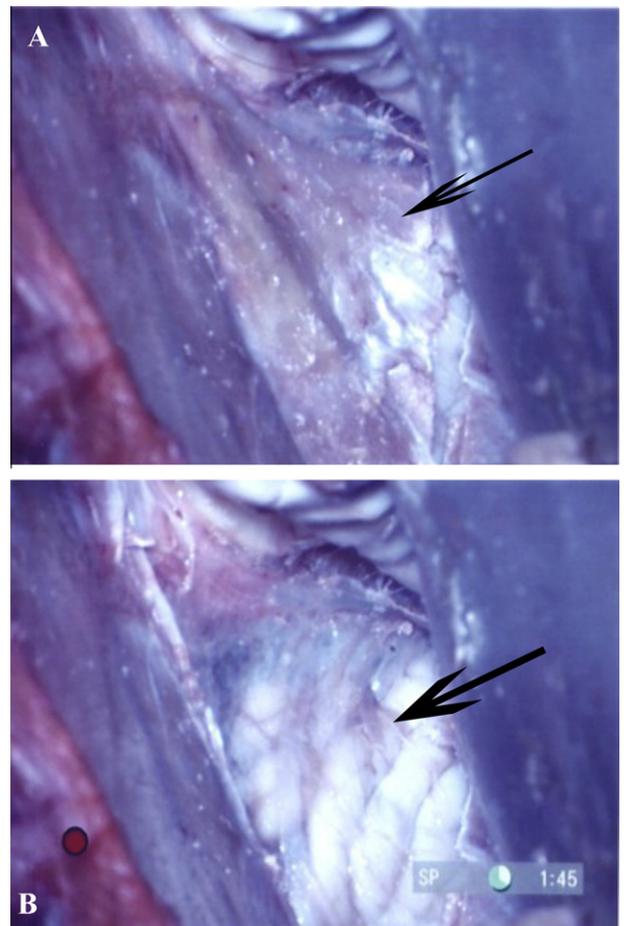


Fig. 2. A cadaveric dissection photograph showing: (A) the tentorium and the falx after performing the craniotomy (arrow, tentorium); and (B) access to the superior cerebellum after the tentorium has been cut (arrow, superior cerebellum).

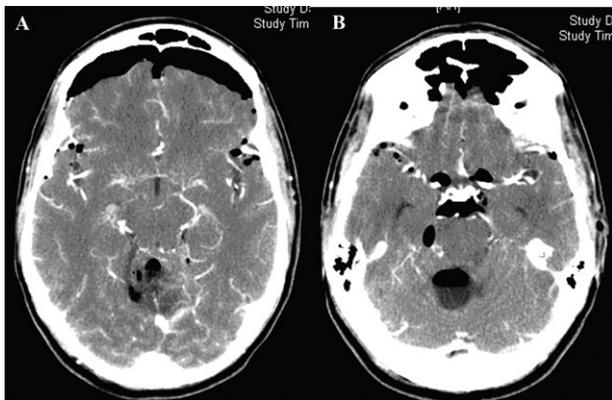


Fig. 3. Postoperative axial CT scans showing complete resection of the lesion.

A supracerebellar infratentorial approach in the sitting position is associated with a risk of an air embolism and the approach may cause the operative neurosurgeon some amount of discomfort.¹¹ The occipital interhemispheric transtentorial approach has been primarily described for pineal region tumors. Since the pineal region is bounded caudally by the cerebellar vermis, tumors or lesions located in this region can be accessed with this approach.¹² The main advantages of this approach are the broad operative field without sacrifice of eloquent neural structures.¹⁰ An occipital transtentorial approach gives greater exposure of the lesion and a better view of the floor of the quadrigeminal region and bilateral trochlear nerves, which are always in the field.² Moreover, the occipital interhemispheric transtentorial approach can extend the operative view ipsilaterally to the posterior temporal gyrus and P2a and P2p segments of the posterior cerebral artery.² The more perpendicular surgical route to the cerebellar surface also facilitates easy access.

The superior cerebellar artery is the major feeding artery of the tumors located in this region.¹⁰ An advantage of this approach is that the surgeon can access this vessel early in the procedure. One disadvantage of this approach, however, is that retraction of the occipital lobe may lead to homonymous hemianopia.¹³ A three-quarter prone approach with the operative side down allows the surgeon to minimize the retraction on the medial side of the occipital lobe. Shirane et al.⁸ used a modified concorde position with the patient's head in a neutral position and the upper body elevated approximately 20° above the horizontal. None of the patients in their series had postoperative hemianopia. Kurokawa et al.¹⁰ adopted the three-quarter prone position and only two patients had transient visual field defect. In our experience we feel that the three-quarter prone position offers greater advantage than the concorde position. The occipital interhemispheric transtentorial approach gives access not only to midline structures but also to tumors 35 mm from the midline because of the wide space.¹⁰

We chose the occipital interhemispheric approach for this patient because the mural nodule was located almost in the midline and in the superior aspect of the cerebellum (Fig. 1E, F) and the trajectory was perpendicular to the cerebellar surface. The lesion could have been approached via a supracerebellar infratentorial approach but we felt that the occipital interhemispheric approach in this patient was more comfortable for the surgeon and it elimi-

nated the risk of an air embolism associated with surgery in a sitting position.

The cyst size increased after stereotactic gamma knife radiosurgery (GKRS) in this patient. The possible mechanism of cystic tumor expansion after GKRS includes osmotic mechanisms from vascular damage, which can cause extravasation of serum proteins into the extracellular matrix.¹⁴ Enlargement of the cystic component may occur regardless of the effectiveness of GKRS for the tumor nodule.¹⁵

6. Conclusion

The occipital interhemispheric transtentorial approach is a useful and safe approach for tumors located in the superior part of the cerebellum. The use of a three-quarter prone position may reduce the incidence of postoperative visual field defect by minimizing the retraction of the occipital lobe. This approach can be safely utilized in properly selected patients. The possibility of cyst enlargement in cystic hemangioblastoma following stereotactic radiosurgery should always be kept in mind.

Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.jocn.2010.04.053.

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