Microsurgical resection of brain stem glioma: 2-dimensional operative video

Christina La Gamma, MD[1]; Phillip Ostrov, MD[2]; Raja Jani, DO[2]; Brian Williams, MD[2]
[1]Department of Surgery, Penn State Health, Milton S. Hershey Medical Center, Hershey, PA
[2]Department of Neurological Surgery, University of Louisville, Louisville, KY

Background

- Brainstem gliomas account for 10-15% of pediatric brain tumors but are less often encountered in adult populations.[1]
- Common brainstem lesions in pediatric and adult populations include cavernoma, medulloblastoma, ependymoma, hemangioblastoma, and metastasis.[2,3]
- Deep location and proximity to important structures like the dentate nucleus and dentate nucleocortical projections make accessing this area challenging.[4,5]
- Few studies document this approach for resecting pontomedullary gliomas.

Surgical approach

- Telovelar approach is advantageous over the traditional transvermian approach for accessing lesions of the brain stem.
- Accessing the 4th ventricle without splitting the cerebellar vermis spares complications like cerebellar mutism.
- Accessing recesses of the lateral ventricle enables safe removal of larger tumors without comprising the entire cavity.[5,6]

Case description

53-year-old male with progressive dizziness, nausea, and blurred vision of one year in the setting of a known enhancing right brainstem lesion since 2023. MR with/without gadolinium showed a showed an exophytic, cystic intra axial right paramidline lesion of the pons and medulla with effacement of the 4th ventricle with a noted increase in size from prior imaging. MR spectroscopy revealed elevated choline and decreased N-acetylaspartate peaks, suggestive of glioma. Initial biopsy was deferred due to hospital admission for methicillin-sensitive Staphylococcus aureus (MSSA) pneumonia and sepsis, with subsequent tracheostomy performed due to imminent respiratory failure. Given increasing size of mass, right extraventricular drain placement followed by telovelar approach for open biopsy was performed. Pathology report identified the lesion as a glial tumor with high Ki67 and loss of H3 K27me3 expression respectively. Postoperative pre/post contrast MRI revealed resection of the cystic cavity with minor residual lesion.

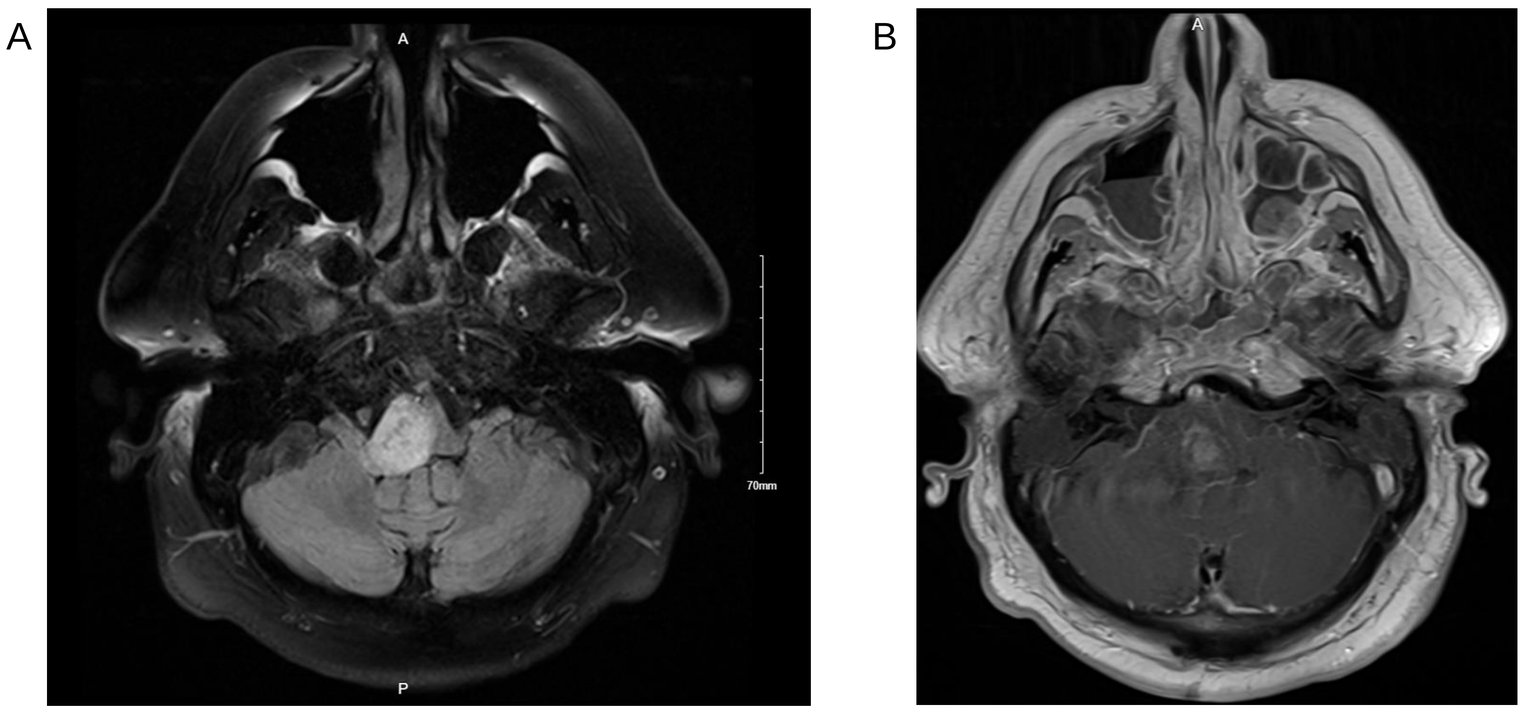

Figure 1. A) Pre-operative axial T2-weight flair and B) T1-weight post contrast sequences demonstrating a 2.5x2.2x3.2 lesion at the pontomedullary brainstem

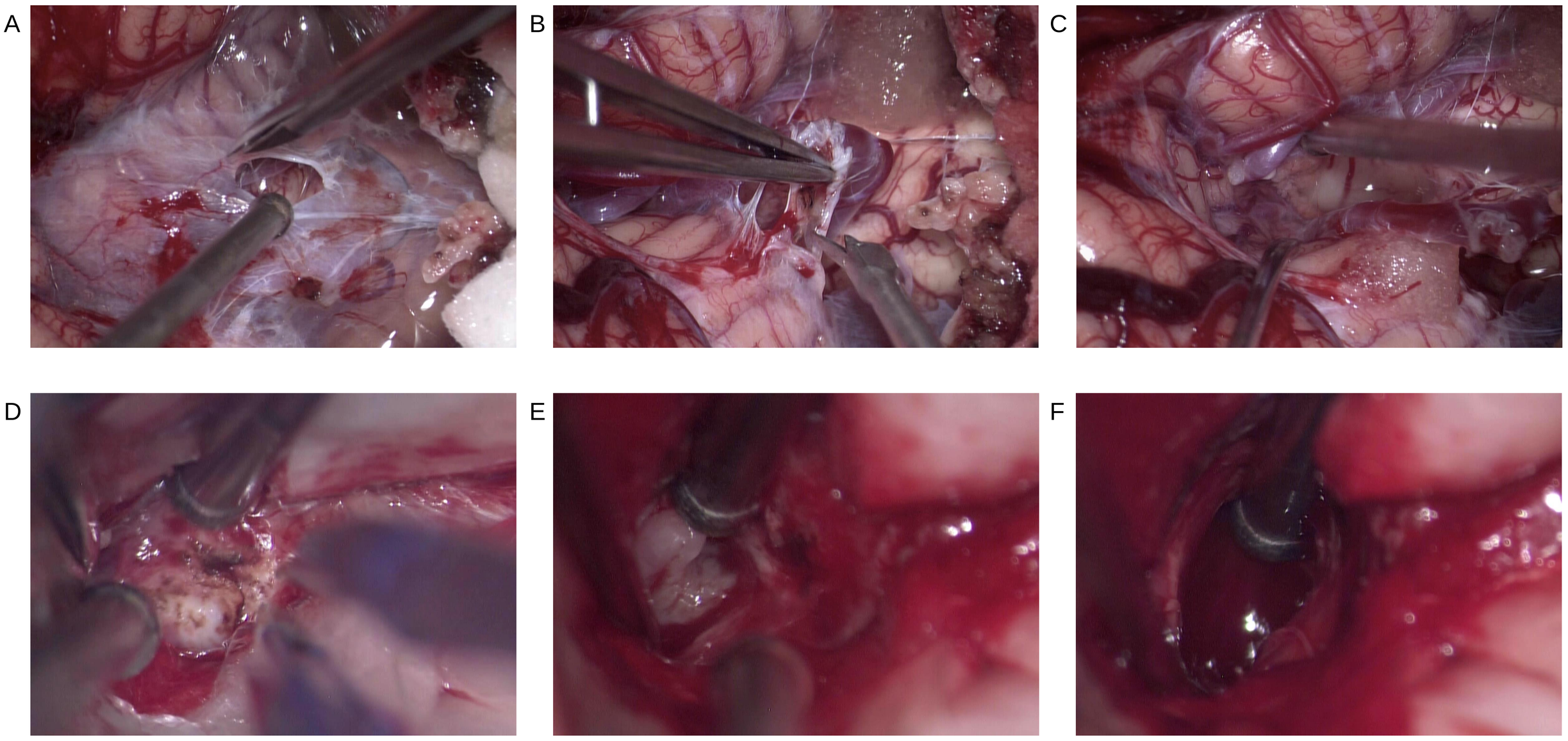

Figure 2. Intraoperative images demonstrating A) arachnoid opening, B) dissection off pia and around PICA, C) identification of the tela choroidia, D) cordiscetomy of the brainstem surface using electrocautery, E) lesion identification, and F) mass defect after resection.

References:

1. Xue, Z. *et al.* Fluorescein-Guided Surgery for Pediatric Brainstem Gliomas: Preliminary Study and Technical Notes. *J. Neurol. Surg. Part B Skull Base* **79**, S340–S346 (2018).
2. Li, D. *et al.* Intramedullary medullocervical ependymoma--surgical treatment, functional recovery, and long-term outcome. *Neurol. Med. Chir. (Tokyo)* **53**, 663–675 (2013).
3. Maenhoudt, W., Hallaert, G. & Kalala, J.-P. Complete Resection of an Intradural Extramedullary Foramen Magnum Cavernous Malformation. *World Neurosurg.* **129**, 200–201 (2019).
4. Grill, J. *et al.* Critical risk factors for intellectual impairment in children with posterior fossa tumors: the role of cerebellar damage. *J. Neurosurg. Pediatr.* **101**, 152–158 (2004).
5. Tomasello, F., Conti, A., Cardali, S., La Torre, D. & Angileri, F. F. Telovelar Approach to Fourth Ventricle Tumors: Highlights and Limitations. *World Neurosurg.* **83**, 1141–1147 (2015).
6. Matsushima, T. *et al.* Microsurgical and Magnetic Resonance Imaging Anatomy of the Cerebellomedullary Fissure and Its Application during Fourth Ventricle Surgery. *Neurosurgery* **30**, 325 (1992).