A Purely Laparoscopic Approach to the Pineal Region

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Introduction:

Surgical options to the pineal region include transventricular, suboccipital transtentorial, supracerebellar infratentorial, transcalloosal, and transparietal approaches. Each has advantages and disadvantages and taken with tumor-specific factors, define an optimal approach. The supracerebellar approach, while favorable, puts strain on the operator with a steep tentorium and a deep legion. Our team developed a purely laparoscopic method for pineal tumor resection via the supracerebellar infratentorial corridor.
Methods (case report):

56-year-old morbidly obese female (BMI=47) presented with headache, vertigo, and gait disturbances and on examination had papilledema, ataxia, dysmetria, and unsteady gait. A 3.8 cm x 3.3 cm falcotentorial meningioma and hydrocephalus were demonstrated on MRI. A third ventriculostomy was performed with gait improvement, yet upon follow-up, her symptoms worsened and the mass increased in size. The patient elected for surgical resection.
Results:

The angle of the tentorium was 43 degrees above the skull base and the distal tumor capsule was 8.5 cm from the dura. The sitting position with slight flexion was selected and central venous access was obtained to detect air emboli. A small trapezoid-shaped craniotomy was performed, and microsurgical dissection accessed the lesion. Long-handled instruments and straight and 30-degree, 45 cm laparoscopes were used for piecemeal resection until a thin rind on the brainstem remained. She recovered well, received adjuvant radiotherapy, and symptoms improved. Pathology revealed a WHO II meningioma, and at 5-year follow-up the small supratentorial remnant remained unchanged, without new symptoms.
Results (cont.):

Contrast-enhanced sagittal MRI demonstrating the large, avidly enhancing pineal mass

Coronal T2 MRI demonstrating the lateral margins of the mass and the mass effect imposed on the ventricular system

Postoperative MRI showing the small residual mass inaccessible beyond the tentorium and adherent to the tectum
The patient in the sitting position with a small degree of neck flexion to facilitate a straight approach to the lesion.

Utilizing a 4-handed technique, the operative team is able to maneuver at the depths of the lesion with relative ease.

Image demonstrating the visualization obtained at the depth of the operative corridor using laparoscopic instruments.
Discussion:

We demonstrate the largest reported solid tumor resection using laparoscopic methods. The steep tentorial angle, the patient’s habitus, and the depth of the lesion contributed to the complexity of the resection and to the consideration of laparoscopic tools to maximize visualization with a wider field of view and enhance maneuverability in the cavity over a standard endoscope. Supratentorial components limit this surgical approach, yet it demonstrates benefit over endoscopic and microscope-based techniques for the reasons stated.
Summary points:

• We report a novel approach to deep pineal lesions using only laparoscopic instruments.

• Laparoscopic instruments provide a deeper working corridor and greater maneuverability compared to standard neurosurgical endoscopes and microsurgical instrumentation.

• The patient’s body habitus and surgical anatomy, as well as surgeon comfort and access were major factors in determining the use of this novel technique.

• We report the largest resection of a falcotentorial meningioma using purely endoscopic/laparoscopic methods.