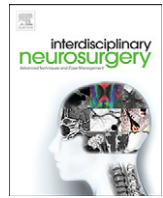




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Case Report & Case Series

Resection of a left posterolateral thalamic cavernoma with the Nico BrainPath sheath: Case report, technical note, and review of the literature



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ABSTRACT

Background: Management of symptomatic cavernomas of the posterolateral thalamus is particularly challenging due to their intimate relationship with the posterior limb of the internal capsule. The risk of continued observation and surgical resection is debilitating motor dysfunction. Traditional microsurgical approaches must be tailored for each lesion and account for the unique and specific anatomic relationships of individual cavernomas. Advances in neuronavigation, MRI, DTI, and tractography have improved the safety of these procedures. Unfortunately, resection remains associated with a significant risk of postoperative morbidity.

Case description: We present a case report of a 44 year-old male with a symptomatic posterolateral thalamic cavernoma for which multiple microsurgical approaches were considered. Ultimately, a complete resection was achieved through a minimally invasive approach with the Nico BrainPath tubular retractor (Indianapolis, IN). Following a brief period of immediate postoperative right-sided hemiplegia, the patient had returned to near neurologic baseline at short-term follow-up.

Conclusion: We believe this to be the first report of a successful resection of a lesion in this anatomic location with this technology. Tubular retractor-guided approaches may represent a valid alternative when addressing cavernomas in this challenging region. Long-term follow-up and larger cases series are necessary to determine if outcomes are comparable to those associated with traditional microsurgical approaches.

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1. Background

The management of cavernomas of the thalamus and basal ganglia is particularly challenging. Their proximity to, and sometimes involvement with, the genu and posterior limb of the internal capsule results in a significant risk of debilitating motor dysfunction, even in the setting of a relatively small hemorrhage [1–7]. Surgical resection is associated with a high risk of neurologic morbidity due to the manipulation and retraction of critical surrounding structures. Location in the dominant hemisphere results in additional risk of resection due to the possibility of a postoperative speech deficit [8]. As a result, observation of these lesions is indicated when asymptomatic or when found incidentally.

Unfortunately, a small subset of these lesions will behave aggressively, resulting in repeated hemorrhage and progressive neurologic deficit. Surgical resection in these cases is warranted to remove the future risk of progressive dysfunction and the risk of life-threatening

hemorrhage [8,9]. Goals of resection are complete removal of the offending lesion and preservation of neurologic function at long-term follow-up [9,10]. The surgical approach must be tailored on an individual basis and take into account the exact location of the cavernoma and its relationship to surrounding structures. An array of microsurgical approaches have been used successfully in the treatment of these lesions. Advances in image guidance, diffusion tensor imaging (DTI), and tractography have allowed for more tailored and safer approaches to these lesions.

A 44 year-old male with a dominant hemisphere cavernoma centered in the posterolateral thalamus and displacing the genu and posterior limb of the left internal capsule presented on two separate occasions with right-sided hemiparesis. The patient made a significant recovery in function and was referred for radiosurgery. Significant weakness and growth of the hematoma occurred at the time of the third hemorrhage and surgical intervention was offered.

We present the first report of a posterolateral thalamic cavernoma successfully resected with the minimally invasive Nico BrainPath tubular retractor. Following a brief period of right hemiplegia and expressive aphasia in the immediate postoperative period, the patient experienced a rapid and dramatic recovery of neurologic function. At short-term follow-up, he had returned to near baseline motor strength and his aphasia was largely resolved. We believe that the tubular retractor

Abbreviations: DTI, diffusion tensor imaging; MRI, Magnetic resonance imaging; MEPs, motor evoked potentials; SSEPs, somatosensory evoked potentials.

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may offer a minimally invasive alternative to traditional microsurgical approaches for the management these challenging lesions. Obviously, a larger series of patients and long-term follow-up are required to determine if results are comparable to those obtained with traditional microsurgical approaches.

2. Case report

2.1. Clinical history

A 44-year-old right-handed male presented to the clinic 6 weeks following the acute onset of mild right hand and leg weakness. At the time of presentation, the weakness had nearly resolved, however, the patient was left with incoordination in his right hand. Noncontrasted head CT demonstrated a mixed-density hemorrhagic mass in the lateral thalamus and posterior limb of the left internal capsule without surrounding edema. Magnetic resonance imaging (MRI) showed a 1.72×1.96 cm well-circumscribed mass and associated blood products consistent with a hemorrhagic cavernoma (Fig. 1). A diagnostic angiogram was negative for underlying vascular malformation. Observation was recommended, as the patient had made a near complete recovery.

Approximately 3 weeks after first presentation, the patient presented to the emergency room with new onset increased weakness in the right upper (4–/5) and lower (4+/5) extremity. MRI demonstrated an increase in the size of the lesion, which now measured 2.4×2.6 cm. DTI and tractography confirmed that the mass was centered in the left lateral posterior thalamus and caused significant lateral displacement of the genu and posterior limb of the left internal capsule (Fig. 2). The patient rapidly recovered to near baseline motor function over the course of 48 h and he was referred for radiosurgery.

12 days later, prior to initiating radiotherapy, the patient presented a third time with 1/5 strength in the right hand, 3/5 strength in the proximal right upper extremity, and 4/5 strength in the right lower extremity. He also had developed mild right facial weakness. MRI again demonstrated a significantly larger lesion, now with a clearly defined 1.8×2.2 cm cavernoma and a surrounding 3.5×3 cm hematoma (Fig. 3). The patient was counseled on the risk of permanent paralysis with continued observation and radiosurgery. He was also informed of the significant risks of surgical resection, including, transient or permanent right hemiparesis or plegia and aphasia. The patient and family agreed to proceed with surgical resection.

2.2. Operative procedure

The patient was placed under general anesthesia and positioned supine on the operating table. Mannitol was not administered and

normocapnia was maintained until the obturator was passed through the white matter, as which point mild hyperventilation was performed. Neuromonitoring, including somatosensory evoked potentials (SSEPs) and motor evoked potentials (MEPs), was performed throughout the procedure. No identifiable left-sided MEPs were present with transcranial stimulation through scalp electrodes.

The head was fixed in the Mayfield three-point clamp and positioned parallel to the floor. Using Stealth neuronavigation the predetermined left frontal starting point was identified on the scalp. A linear paramedian incision was planned over the starting point. A small left frontal craniotomy was performed and an epidural lead was placed over the left motor strip. Left-sided MEPs were identified in the right deltoid and foot with stimulation through the epidural electrode. A small dural incision was made over the starting point and the target sulcus was identified. The sulcus was opened superficially with an arachnoid knife.

A 75 mm sheath was selected to traverse the 70 mm between the frontal starting point and the posterior inferior margin of the cavernoma. The obturator extends 15 mm beyond the distal end of the sheath and this distance must be incorporated into the planning. Using the Stealth navigation wand and obturator, the tubular retractor was advanced into position and secured to the Greenberg retractor. MEPs were immediately checked following trocar placement and the right deltoid and foot signals could no longer be identified through epidural stimulation.

The operating microscope was brought into the field and the hematoma was easily identified within the tubular retractor (Fig. 4). The hematoma and pieces of the cavernoma were removed systematically until the visualized field was clear. The tube was then progressively withdraw to allow additional hematoma and cavernoma to “fall” into the field. This process was repeated until the cavernoma and hematoma had been completely resected. The right deltoid and foot MEPs did not recover during the procedure, while SSEPs remained unchanged. Permanent section confirmed a cavernoma and associated hematoma.

The patient awakened in the operating room with a complete right hemiplegia, expressive aphasia, and a worsening right facial paralysis. Within 12 hours the patient improved to a 3/5 strength in the right upper extremity and 4–/5 strength in the right lower extremity. His facial weakness recovered to baseline over the following 48 h. At the time of discharge 1 week later, he was ambulating with physical therapy. The proximal right upper and lower extremities had improved to 4+/5 strength. Unfortunately, the right hand remained plegic. MRI performed on postoperative day six demonstrated complete resection of the cavernoma, although this will require confirmation with repeat MRI in 3 to 6 months. Postoperative DTI and tractography demonstrated reduced mass effect on the posterior limb of the internal capsule (Fig. 5).

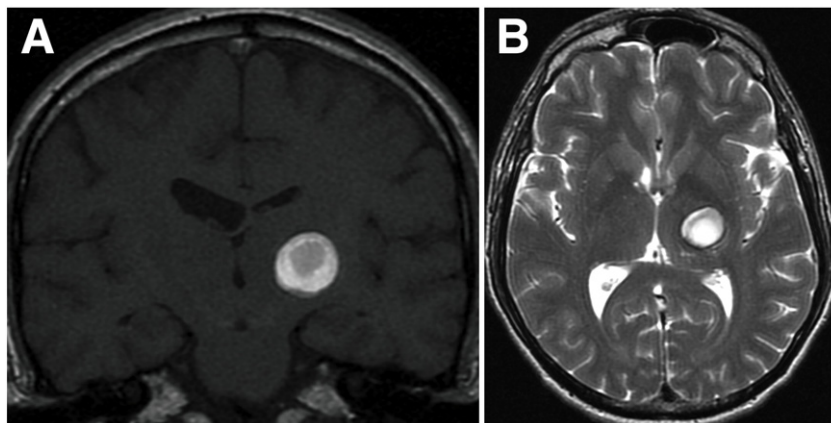


Fig. 1. MRI at presentation following first symptomatic hemorrhage. T1 (A) coronal and T2 (B) axial MRI demonstrating a 1.72×1.96 cm well-circumscribed lesion and associated blood products consistent with a hemorrhagic cavernoma. The cavernoma is centered in the lateral left thalamus and posterior limb of the internal capsule.

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