Minimally Invasive Resection of a Spinal Epidural Cavernous Hemangioma

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ABSTRACT

Objective and Importance

Minimally invasive techniques for spinal surgery are rapidly evolving. We present a rare case of a symptomatic spinal epidural cavernous hemangioma that was treated using minimally invasive surgical techniques. The pathophysiology, radiology, and histology of epidural cavernous hemangiomas are reviewed. The advantages and pitfalls of minimally invasive spinal surgery techniques are discussed.

Clinical Presentation

A 45 year-old woman presented with a four-year history of right leg weakness and difficulty with ambulation. MRI examination of the lumbar spine revealed an epidural mass.

Intervention

The patient elected to undergo a minimally invasive, microendoscopic resection of the lesion. The MetRx™ (Medtronic, Memphis, TN) dilator system was employed to gain access to the L2 lamina. A hemilaminectomy and resection of the lesion was accomplished without complication.

Conclusion

Spinal epidural masses, in this case a cavernous hemangioma, can be safely and effectively treated with minimally invasive techniques. With decreased soft tissue injury, minimal blood loss, and shortened operative time, minimally invasive techniques should be considered when resecting epidural masses.

Key words: cavernous hemangioma, cavernous malformation, epidural, minimally invasive surgery, spine

Spinal Surgery 19 (3) : 235~240, 2005

Introduction

Minimally invasive techniques for spinal surgery are rapidly evolving. Minimally invasive approaches, including tubular retraction systems, endoscopic visualization, and microsurgical techniques have been developed for the removal of extruded intervertebral disc fragments [13]. Spine surgeons, however,

encounter numerous other mass occupying lesions in the spinal epidural space including neoplasms, inflammatory tissue, and vascular malformations. The use of a minimally invasive approach for the entire spectrum of mass occupying lesions in the spinal epidural space is a logical extension of these techniques.

We present the case of a patient with a rare,

(Received : February 14, 2005, Accepted : June 17, 2005)

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symptomatic, lumbar epidural cavernous hemangioma that was treated using minimally invasive techniques. We review the pathophysiology, radiology, and histopathology of spinal, epidural cavernous hemangiomas and discuss the advantages and pitfalls of a minimally invasive surgical approach. Although epidural cavernous hemangiomas are rare clinical entities, we believe that these surgical techniques may be useful for other spinal epidural lesions.

Case Report

Presentation

A 45 year-old woman presented to our clinic with a four-year history of bilateral radicular pain and lower extremity weakness. In the months prior to presentation, the patient noted progressive weakness in her right leg requiring the use of a cane for ambulation.

Exam

The patient's physical exam was significant for decreased (4/5) strength in the right iliopsoas, quadricep, and hamstring muscles. The patient demonstrated a right sided limp on ambulation. Proprioception of the right lower extremity was diminished.

Radiological Findings

The patient underwent radiological examination with an MRI of the lumbar spine with gadolinium. An approximately 1.5 cm x 1.5 cm epidural lesion with impingement of the thecal sac was noted at the L2/L3 level (Figure 1).

Surgery

After a thorough discussion with the patient about the risks and benefits of both a minimally invasive and "open" surgery, she elected to undergo a minimally invasive approach to the lesion. The patient was taken to the operating room, administered general anesthesia, and placed in a prone position. Using fluoroscopic guidance, the L2/L3 intervertebral space was identified. An approximately 2 cm paramedian skin incision was made 1.5 cm off of midline. Under

Figure 1. Pre-operative MRI (T1WI with gadolinium) sagittal image of the thoracolumbar spine

fluoroscopic guidance, a K-wire was advanced to dock on the L2 lamina. Care was taken to avoid inserting the K-wire through the interlaminar space. Using fluoroscopic visualization to ensure that the K-wire remained in place, the MetRx™ (Medtronic, Memphis, TN) tubular dilators were inserted in series. The final dilator was 23 mm in width and was attached to a rigid holding arm. The smaller dilators were removed, and using endoscopic visualization, a small amount of soft tissue over the L2 lamina was removed with bovie cautery. A unilateral hemilaminectomy was performed with the high-speed drill and Kerrison rongeur. The ligamentum flavum was removed with the angled curette and Kerrison rongeur. The epidural mass was quickly identified under the ligamentum flavum. Using the bipolar cautery to maintain hemostasis and standard microsurgical techniques, a plane was dissected around the mass, and it was removed en bloc (Figure 2). The tubular retractor was removed, and the wound was irrigated and closed.

Figure 2. Surgical specimen, a cavernous hemangioma, removed from epidural space

Figure 3A. Low power magnification of histological section of the excised spinal epidural cavernous hemangioma (H&E)

Figure 3B. High power magnification of histological section of the excised spinal epidural cavernous hemangioma (H&E)

Figure 4A. Post-operative MRI (T2 WI) sagittal image of the thoracolumbar spine

Figure 4B. Post-operative MRI (T1 WI with gadolinium) axial image of the L2-3 region

Histopathological Findings

Histological examination of the epidural mass revealed irregular, ectatic vascular channels on a background of collagen and fibrous tissue (Figure 3). Many of the channels were filled with blood. The walls of the channels consisted of a single layer of flattened endothelial cells and lacked elastic fibers and smooth muscle cells. Hemosiderin deposition was

not seen at the periphery of the lesion. A diagnosis of cavernous hemangioma was made.

Post-operative Course

After surgery, the patient recovered in the same-day surgery center and was discharged home four-hours after surgery. Six-weeks after surgery, her right leg strength had returned to 5/5, and she was able to

ambulate without a cane. The patient's proprioception also improved. An MRI at six-weeks after surgery showed no evidence of a remaining lesion (Figure 4).

Discussion

Minimally invasive techniques are being used more frequently in spinal surgery. These techniques enable surgeons to make smaller skin incisions and minimize soft tissue retraction. In the present case the use of a tubular retraction system and fluoroscopic visualization permitted the surgery to be completed through a two-centimeter skin incision. Several reports have suggested that minimally invasive spinal surgery techniques reduce post-operative pain and shorten in-hospital stays [6, 11]. Reduced post-operative pain may be associated with minimized soft tissue retraction [3]. In this case the patient was discharged from the hospital several hours after the surgery was completed.

The use of endoscopic visualization and microsurgical instruments specifically designed for tubular retraction systems facilitated the delicate dissection of this lesion. Based upon the senior author's (RGF) experience, endoscopic cameras provide superior visualization for minimally invasive spinal procedures. However, many surgeons are more familiar with the surgical microscope for visualization, and it is likely that an experienced minimally invasive spine surgeon could perform this surgery using the surgical microscope to see through the tubular retraction system.

Spinal epidural cavernous hemangiomas are rare clinical entities. An incidence of 0.22 symptomatic cases/million/year was reported in 1991 [10]. Although these calculations were based on a 24-year survey of a strictly defined population, many of the cases predated MRI diagnosis and advanced microsurgical techniques. The infrequency of these lesions makes an accurate assessment of incidence difficult to obtain. Of the approximately 100 reported cases, the majority of lesions are located in the upper thoracic spine [20]. Most frequently, they cause signs and symptoms by mass effect leading to slow, progressive spinal cord compression [7, 9, 10]. Local

pain and radiculopathy are also common, and acute spinal cord compression has been reported [7, 9, 16].

MRI provides the most sensitive and specific pre-operative images of spinal cavernous hemangiomas [2, 4, 17, 18]. Cavernous hemangiomas display low or intermediate signal intensity on T1 weighted images and high signal intensity on T2 weighted images [5]. Epidural cavernous hemangiomas lack several of the unique MRI characteristics of their intradural counterparts. Epidural lesions usually do not display a low signal hemosiderin ring on all sequences, likely due to removal of blood breakdown products more effectively outside the blood-brain barrier [22]. In addition, the telltale heterogeneous, reticulated, "popcorn-like" core seen in intradural lesions is absent in epidural lesions [1].

Because epidural cavernous hemangiomas are rare, the pre-operative radiographic diagnosis may be confused with more common lesions such as herniated intervertebral discs [8, 19]. Angiography provides little additional information because most cavernous malformations are angiographically occult [15]. The MRI differential includes: free-fragment herniated disc, epidural tumor (nerve sheath tumor most commonly), infiltrating disease, abscess, and epidural cyst [19, 22]. Morphological characteristics that should increase suspicion of an epidural cavernous hemangioma include round or ovoid shape, absence of a direct anatomic relationship with the intervertebral disc or exiting nerve root, and extension through the intervertebral foramen (although not present in our case) [7, 8, 10, 14, 19].

Regardless of their location, all cavernous hemangiomas display similar histological characteristics [7, 9]. Irregular, sinusoidal vascular spaces are closely packed with walls consisting of a single layer of flattened endothelial cells in a collagenous background [9, 20, 21]. Our histological sample contained islands of fibroadipose tissue mixed between the vascular spaces.

The present case highlights another step forward for minimally invasive spinal surgery. Minimally invasive techniques have been described for spinal decompression and instrumentation [6, 11, 12] as well as resection of extruded intervertebral disc fragments [13]. The resection of other epidural lesions is a

logical extension of these minimally invasive techniques. However, minimally invasive techniques have limitations. Tubular retraction systems rely greatly on fluoroscopic visualization for localization of lesions. Fluoroscopic visualization may be very limited or impossible in patients with lesions in the upper thoracic spine or patients who are obese. In addition, very large lesions may be better accessed using open surgery. Finally, highly vascular lesions such as spinal AVMs, for which control of feeding vessels is necessary, may not be amenable to the limited exposure of tubular retraction systems.

To the authors' knowledge, the present case is the first report of minimally invasive techniques used to treat a spinal epidural cavernous hemangioma. Although epidural cavernous hemangiomas are rare, the minimally invasive techniques described in this report could be used for other spinal extradural lesions including neurofibromas, chordomas, and metastatic lesions.

References

1. Carlier R, Engerand S, Lamer S, Vallee C, Bussel B, Polivka M: Foraminal epidural extra osseous cavernous hemangioma of the cervical spine: a case report. *Spine* 25: 629-631, 2000
2. Daneyemez M, Sirin S, Duz B: Spinal epidural cavernous angioma: case report. *Minim Invasive Neurosurg* 43:159-162, 2000
3. Datta G, Gnanalingham KK, Peterson D, Mendoza N, O'Neill K, Van Dellen J, McGregor A, Hughes SP: Back pain and disability after lumbar laminectomy: is there a relationship to muscle retraction? *Neurosurgery* 54: 1413-1420, 2004
4. Del Curling O, Jr., Kelly DL, Jr., Elster AD, Craven TE: An analysis of the natural history of cavernous angiomas. *J Neurosurg* 75: 702-708, 1991
5. Enomoto H, Goto H: Spinal epidural cavernous angioma. MRI finding. *Neuroradiology* 33: 462, 1991
6. Fessler RG, Khoo LT: Minimally invasive cervical microendoscopic foraminotomy: an initial clinical experience. *Neurosurgery* 51 (suppl 2): 37-45, 2002
7. Graziani N, Bouillot P, Figarella-Branger D, Dufour H, Peragut JC, Grisoli F: Cavernous angiomas and arteriovenous malformations of the spinal epidural space: report of 11 cases. *Neurosurgery* 35: 856-863, 1994
8. Harrington JF, Jr., Khan A, Grunnet M: Spinal epidural cavernous angioma presenting as a lumbar radiculopathy with analysis of magnetic resonance imaging characteristics: case report. *Neurosurgery* 36: 581-584, 1995
9. Harrison MJ, Eisenberg MB, Ullman JS, Oppenheim JS, Camins MB, Post KD: Symptomatic cavernous malformations affecting the spine and spinal cord. *Neurosurgery* 37: 195-204, 1995
10. Hillman J, Bynke O: Solitary extradural cavernous hemangiomas in the spinal canal. Report of five cases. *Surg Neurol* 36: 19-24, 1991
11. Khoo LT, Fessler RG: Microendoscopic decompressive laminotomy for the treatment of lumbar stenosis. *Neurosurgery* 51 (suppl 2): 146-154, 2002
12. Khoo LT, Palmer S, Laich DT, Fessler RG: Minimally invasive percutaneous posterior lumbar interbody fusion. *Neurosurgery* 51 (suppl 2): 166-181, 2002
13. Maroon JC: Current concepts in minimally invasive discectomy. *Neurosurgery* 51 (suppl 2): 137-145, 2002
14. Morioka T, Nakagaki H, Matsushima T, Hasuo K: Dumbbell-shaped spinal epidural cavernous angioma. *Surg Neurol* 25: 142-144, 1986
15. Padovani R, Tognetti F, Proietti D, Pozzati E, Servadei F: Extrathecal cavernous hemangioma. *Surg Neurol* 18: 463-465, 1982
16. Richardson RR, Cerullo LJ: Spinal epidural cavernous hemangioma. *Surg Neurol* 12: 266-268, 1979
17. Rigamonti D, Hadley MN, Drayer BP, Johnson PC, Hoenig-Rigamonti K, Knight JT, Spetzler RF: Cerebral cavernous malformations. Incidence and familial occurrence. *N Engl J Med* 319: 343-347, 1988
18. Robinson JR, Awad IA, Little JR: Natural history

- of the cavernous angioma. *J Neurosurg* 75: 709-714, 1991
19. Rovira A, Capellades J, Zauner M, Bella R, Rovira M: Lumbar extradural hemangiomas: report of three cases. *AJNR Am J Neuroradiol* 20: 27-31, 1999.
20. Saringer W, Nobauer I, Haberler C, Ungersbock K: Extraforaminal, thoracic, epidural cavernous haemangioma: case report with analysis of magnetic resonance imaging characteristics and review of the literature. *Acta Neurochir (Wien)* 143: 1293-1297, 2001
21. Simard JM, Garcia-Bengochea F, Ballinger WE, Jr., Mickle JP, Quisling RG: Cavernous angioma: a review of 126 collected and 12 new clinical cases. *Neurosurgery* 18: 162-172, 1986
22. Slavotinek JP, Fowler S, Sage MR, Brophy BP: Extradural cavernous haemangioma simulating a disc protrusion. *Australas Radiol* 43: 111-112, 1999

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Spinal epidural cavernous hemangiomas is uncommon. This manuscript reports a case of spinal epidural cavernous hemangioma, which was resected during microendoscopic surgery. It seems that this is the first such report in the literature. The authors used minimally invasive technique, tubular retraction systems, endoscopic visualization, and microsurgical techniques to treat epidural cavernous hemangioma. Minimally invasive techniques for spinal surgery are evolving recently, which appears to offer a similar short-term clinical outcome with a significant reduction in operative blood loss and postoperative stay. This lower surgical stress, decreased tissue trauma, and quicker recovery are particularly important in this elderly population of patients. Minimally invasive microendoscopic surgery is a safe and effective procedure for cervical and lumbar disease so it may be used more frequently in spinal surgery in future.

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This case report highlights a minimally invasive, microendoscopic resection of the epidural cavernous angioma at the L2 region. This technique has been increasing in popularity in performing spinal instrumentation as well as resection of intervertebral herniated discs caused by small skin incision, reduced soft tissue injury, and short hospital stay. As the authors recommend, this less invasive technique should be introduced in resecting the other epidural lesions. However, the size, location, and vascularity should be carefully examined preoperatively to avoid unexpected complications.