Durectomy and reconstruction for the treatment of a recurrent spinal meningioma

Case report

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The management of spinal meningiomas with extensive involvement of the dura mater is controversial. The principal difficulty in performing a resection is the potential for complications associated with this approach. The authors present the case of a pregnant 35-year-old woman in whom bilateral lower-extremity numbness, weakness, gait ataxia, and myelopathy developed. Magnetic resonance imaging showed a recurrent thoracic meningioma with extensive infiltration of the dura mater. Durectomy, complete resection, and reconstruction were performed. The patient has not experienced a recurrence 21 months after her treatment. This case illustrates that thoracic spinal meningiomas with extensive dural involvement can be resected safely with a complete durectomy. The novel dural reconstruction involving the implantation of a fascia lata and bovine pericardial allograft is an effective way to reconstruct the dura to create an adequate barrier to cerebrospinal fluid.

KEY WORDS • dural reconstruction • dural infiltration • recurrent meningioma

Meningiomas of the spine are usually intradural extramedullary lesions and account for approximately 40% of all spinal cord tumors in adults. Typically, they develop in the thoracic spine and most occur in females. The natural history, treatment outcomes, and recurrence rates of intradural spinal meningiomas have been described extensively. A controversial issue related to the treatment of these lesions is the need for extensive dural resection or diathermic treatment of the dural attachment. We describe the technical aspects of a complete durectomy and complex reconstruction used to treat a recurrent thoracic meningioma.

Case Report

Examination. When she was 4 months pregnant, this 35-year-old woman experienced bilateral lower-extremity numbness, weakness, gait ataxia, and myelopathy. She underwent a therapeutic abortion because of intrauterine fetal death. Her weakness worsened after surgery and independent ambulation became difficult. Her bowel and bladder functions were intact. On neurological examination, the patient exhibited lower-extremity weakness (Grade 4/5), diminished pinprick and light touch sensation, increased lower-extremity reflexes, clonus, and Babinski sign. Her gait was spastic. Magnetic resonance imaging revealed an extramedullary mass at the T1–3 level located off the midline to the right and associated with severe compression of the thecal sac (Fig. 1).

Operation. The patient underwent a T1–4 laminectomy and microsurgical excision of the tumor. The tumor was primarily extradural with an intradural extension. The areas where the tumor was attached to the dura mater were coagulated extensively. At the time of surgery, we believed that a gross-total resection had been achieved. No spinal fixation was required, and the dura was closed primarily without duraplasty or excision of the dura. Immediate postoperative MR imaging verified gross-total resection. After 3 days in the hospital, the patient was discharged home neurologically intact. All preoperative deficits and myelopathy had resolved.

Second Operation. An MR image obtained at the 1-year follow-up visit showed substantial regrowth of tumor at the same level surrounding the spinal cord (Fig. 2). The patient underwent a right costotransversectomy and a bilateral transpedicular approach to the tumor. The T1–3 nerve roots were sacrificed bilaterally so that the tumor could be resected completely. The dura mater was completely infiltrated by tumor and thus was resected circumferentially. Fascia lata, bovine pericardium, and fibrin glue were used to complete the dural reconstruction. Two small areas ventrally at the cranial and caudal aspects of the reconstruction site could not be completely sutured and fibrin glue was used instead. Drawings of the reconstruction procedure are

Abbreviations used in this paper: CSF = cerebrospinal fluid; MR = magnetic resonance.
Durectomy for spinal meningioma

Fig. 1. Sagittal T₁-weighted contrast-enhanced MR image shows a large meningioma surrounding the spinal cord.

shown in Fig. 3. Because of extensive scarring and tumor bleeding, the planned placement of posterior instrumentation was abandoned at the time of resection. Postoperative MR imaging verified the absence of residual tumor. After the second resection, the patient experienced mild spasticity, lower-extremity weakness, and very mild weakness of her intrinsic hand muscles. She underwent close observation to detect instability or kyphosis.

Third Operation and Postoperative Course. After 6 months, the patient continued to be tumor free, (Fig. 4) but a significant kyphotic deformity developed. The deformity was reduced via an anterior release and cervicothoracic fusion. Planned posterior supplemental fusion was abandoned after a decubitus ulcer developed on her back following the anterior fixation procedure. The ulcer was allowed to heal, and we observed no signs of kyphotic progression; thus the posterior fixation was indefinitely postponed. She was closely observed and 21 months after the last treatment radiography demonstrated a solid fusion, the patient was neurologically intact, and MR imaging showed no evidence of recurrence.

Discussion

Intradural meningiomas usually have a limited attachment to the dura mater, allowing complete resection to be performed in a safe manner that provides a lasting cure.¹,³,⁵,⁶,¹⁰,¹¹ The standard practice in treating the area of dural attachment is to perform bipolar diathermy to destroy any tumor cells. Alternatively, a wide dural excision and a simple duraplasty can be performed. One line of thought is that the extent of dural resection has no correlation with the recurrence rate of these tumors.⁹,¹⁰ When a large portion of the dura mater is involved or in cases of recurrence and dural involvement, the usefulness of complete dural resection

Fig. 2. Sagittal T₁-weighted contrast-enhanced MR image obtained 1 year after initial resection revealing the recurrent meningioma with extensive dural infiltration.

Fig. 3. Illustrations showing the cross-sectional view of the spinal cord before tumor resection and durectomy (A). The fascia lata autograft is placed around the spinal cord as shown in a posterior view (B). Cross-sectional (C) and posterior (D) views showing the final construct. Reprinted with permission from Barrow Neurological Institute.
or subtotal tumor resection becomes a question. The recurrence rate associated with subtotal resection is significantly higher than that associated with total resection. Therefore, we favor complete excision, especially in patients younger than 50 years of age, in whom the reported recurrence rate is as high as 22%.

If a complete durotomy is to be performed, achieving adequate closure can be challenging. In the present case, we planned to undertake a durotomy and placement of a fascia lata graft. However, the extent of resection was greater than the amount of autograft that could be obtained. Although we prefer to use autologous material, we elected to add a small piece of bovine pericardium graft.

When these tumors involve the ventral portion of the dura mater in the thoracic spine, a more aggressive approach is needed to achieve complete resection. We used a multi-level transpedicular approach and successfully resected the tumor; to date we have noted no recurrence. However, the patient must be observed for the rest of her life because recurrences have been diagnosed as long as 14 years after resection. In our patient, however, delayed kyphosis developed and required fixation and fusion. It is important to recognize the potential risks of kyphosis when using the transpedicular approach. Surgeons must be prepared to perform fixation and fusion in patients prophylactically or to monitor them closely by obtaining follow-up serial radiographs.

We have demonstrated the technical feasibility of performing a complete durotomy and dural reconstruction in a patient with a recurrent thoracic meningioma. This new technique can be used to completely resect meningiomas with extensive dural involvement and has great potential for achieving a permanent cure of the tumor.

References


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