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Technical Notes

Use of Saito technique to resect an anterior lumbar spine meningioma: Technical note

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ABSTRACT

Background: Complete (Simpson Grade I: total removal) resections for anterior spinal meningiomas are especially challenging. This is largely attributed to difficulty obtaining a water-tight dural repair where the tumor has infiltrated the dura requiring duroplasty, thus often resulting in just a Simpson Grade II resection (i.e. coagulation of the dural implantation site). Here, we present a 56-year-old female who underwent resection of a ventral lumbar meningioma utilizing the Saito technique, that effectively separated the dura into two layers, removing just the inner layer but leaving the outer layer intact for direct dural repair.

Methods: A 56-year-old female underwent a L1–L2 laminectomy. The anterior intradural resection of tumor was achieved with the Saito technique; this required cutting circumferentially around the tumor insertion site, and removing only the inner layer.

Results: Postoperatively, the patient did well without tumor recurrence over 8 years. The postoperative biopsy confirmed a World Health Organization Grade I meningothelial meningioma.

Conclusion: Saito's technique proved to be a safe and effective method for achieving gross total resection of an anterior lumbar meningioma.

Keywords: Dural preservation, Recurrence, Simpson grade, Spinal meningioma, Surgical technique

INTRODUCTION

Spinal meningiomas represent 25–46% of all spinal intracanalicular tumors.[12] They are considered the second most-common lesions, only surpassed by schwannomas. However, complete resection may prove challenging for anterior spinal meningiomas, particularly for those with dural invasion requiring dural resection and reconstruction.[3,6,9] Therefore, many surgeons frequently achieve only Simpson Grade II (i.e. coagulation of the dural implantation site) rather than Grade I resections (i.e. total removal) to avoid the wound/healing complications and pseudomeningoceles associated with persistent cerebrospinal fluid (CSF) leakage.

In 2001, Saito *et al.*[10] recommended gross total resection of posterior spinal meningiomas by separating the inner from the outer dural layers, removing the inner layer alone (i.e. that was infiltrated by tumor), and preserving the outer layer for closure (i.e. only if not clearly invaded).

Here, we present a 56-year-old female with an anterior lumbar meningioma that was effectively surgically removed using Saito's technique.

CASE ILLUSTRATION

A 56-year-old female was diagnosed on an enhanced MR with an anterior L1–L3 intradural mass. She had complained of lumbar radiculopathy for the past 3 years and was neurologically intact [Figure 1].

Technique

The patient underwent a routine L1–L2 laminectomy. Under the microscope, utilizing a bipolar and micro-scissors, the tumor was resected in a piecemeal fashion; then, the inner portion of the dura was resected leaving the outer dura for closure [Figure 2]. The inner dural layer was resected and sent for biopsy, leaving the outer layer intact. The biopsy and final pathology confirmed a World Health Organization Grade I meningothelial meningioma that partly infiltrated the inner layer of the dura mater (i.e. not the outer layer); the Ki67 labeling index was 5% [Figure 3]. The posterior dural sac incision was routinely closed and supplemented with a fat graft with DuraSeal® (Integra Life Sciences, Plainsboro, NJ). The patient sustained no postoperative complications and was asymptomatic with no evidence of recurrence 8 years later [Figure 3].

DISCUSSION

In 2001, Saito *et al*. published a novel technique to achieve total resection of spinal meningiomas by excising only the inner layer of dura involved, while preserving the outer layer for dural closure.[10] The primary objective of meningioma surgery is to achieve a Simpson I total resection and, therefore, reduce the risk of recurrence. However, such total resections, particularly for anteriorly placed spinal lesions, are often not routinely performed due to the risk of incurring postoperative CSF leaks [Table 1].[11] Therefore, many "complete resections" are actually Simpson Grade II partial removals (i.e. coagulation of the dural implantation site).[11] In this case of an anterior lumbar meningioma, a Simpson Grade I removal was achieved without tumor recurrence for the subsequent 8 years.

Figure 1: Preoperative contrast-enhanced sagittal (a) and axial (b) lumbar spine MRI showing an intradural and extramedullary enhanced round mass at the L1–L2 disc level. The tumor originated in the ventral dura and occupied most of the spinal canal.

Higher tumor recurrence rates for Grade II Simpson resections

Several studies emphasized that Simpson Grade II resections for ventrally located spinal meningiomas resulted in higher tumor recurrence rates. Nakamura *et al*.[7] showed that six out of 17 ventral meningiomas (35.3%) recurred after Simpson Grade II removal. The most important findings of this study were that there was no tumor recurrence in any of 43 patients treated by Simpson Grade I resection and six (32%) of 19 patients treated by Simpson Grade II resection developed recurrence between 6 and 21 years (mean: 12.2 years) after the operation. Similarly, Postalci *et al*.,[8] in a study with 46 spinal meningiomas, found that five out of seven (71%) ventral meningiomas recurred after resections [Table 1].

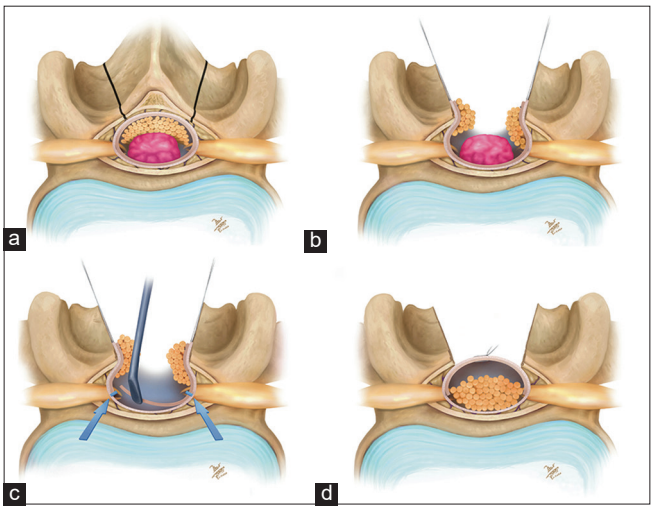

Figure 2: Schematic of the operative technique. (a) The figure shows a cross section of the lumbar spine at the tumor level. (b) Conventional laminectomy was performed to expose the relevant site. After lateral displacement of the cauda equina roots, the tumor was removed with microsurgical technique. (c) After tumor removal, the inner layer of the dura was cut around the tumor implantation site (arrows), dissected away from the outer layer with a # 6 Rhoton dissector, and removed. (d) Primary closure of the posterior dura. Preservation of outer layer of the anterior dura avoided cerebrospinal fluid leakage and pseudomeningocele.

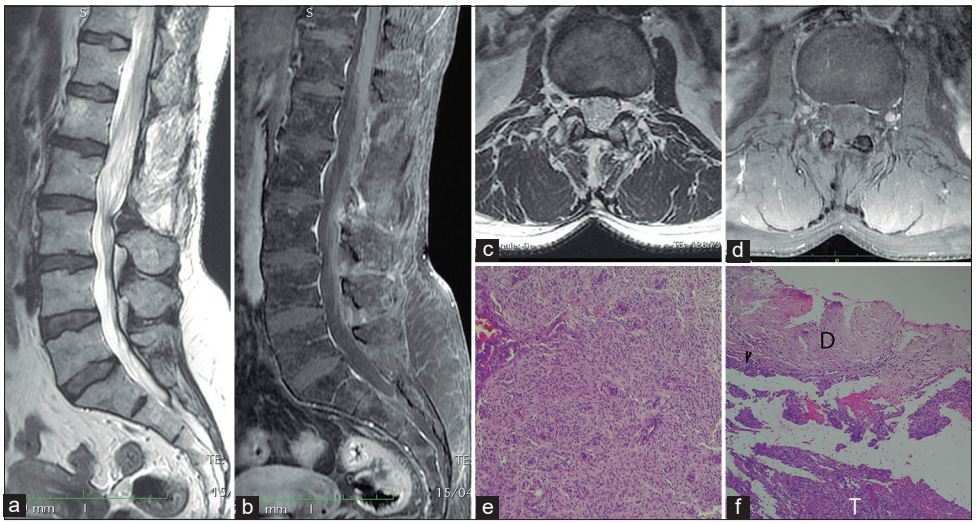

Figure 3: Postoperative (8-year follow-up) contrast-enhanced lumbar spine MRI. (a) T2-weighted sagittal image showing complete resection of the meningioma. (b) Postcontrast fat-saturated T1 sagittal image. No dural tail was seen around the tumor implantation site. (c) T2-weighted axial image showing complete resection of the meningioma. (d) Postcontrast fat saturated T1 axial image at L1–L2 disc level. Note the tenuous dural enhancement at the tumor implantation site following the resection of the inner dural layer. (e and f) Photomicrographs of hematoxylin-eosin stained tissue (original magnification ×10). (e) Meningothelial meningioma. (f)This section shows the dural attachment of the meningioma (T) resected together with the inner layer of the dura (D). Note the tumor invasion only into the innermost part of this layer (black arrowhead), with no signs of compromising the outer potion of the inner layer.

Table 1: Literature review on surgical series of ventral spinal meningiomas.

Author and Year	Study design and Statistical analysis	*n*	Ventral meningiomas (%)	Simpson I resection	Simpson II resection	Partial resection *n* (%)	Permanent neurological complications *n* (%)	Recurrence
Roux *et al.*, 1996	Retrospective and Descriptive	54	21 (39%)	0	17 (81%)	4 (19%)	1 (4.7%)	2 (9.5%)
King *et al.*, 1998	Retrospective and Descriptive	78	30 (38%)	0	29 (96%)	1 (3.3%)	2 (6.6%)	1 (3.3%)
Sandalcioglu *et al.*, 2008	Retrospective and Descriptive	131	38 (29%)	0	36 (95%)	2 (5.2%)	2 (5.2%)	3 (7.9%)
Boström *et al.*, 2008	Retrospective and Descriptive	61	12 (20%)	0	11 (91.7%)	1 (8.3%)	0	1 (8.3%)
Postalci *et al.*, 2011	Retrospective and descriptive	46	7 (15%)	0	1 (14%)	6 (85.7%)	0	5 (71.4%)
Nakamura *et al.*, 2012	Retrospective and descriptive	68	38 (55%)	19 (50%)	17 (45%)	2 (5.2%)	N/A	6 (15.8%)
Kim *et al.*, 2015	Retrospective and descriptive	58	30 (52%)	2 (6.6%)	15 (50%)	13 (43.3%)	2 (6.6%)	9 (30%)

Lower recurrence rates but higher morbidity with Simpson Grade I meningioma resections

In a retrospective review of 20 patients, Kim *et al.*[4] concluded that a Simpson Grade I removal was less frequently performed for ventral meningiomas lesions, and the recurrence rate was 5% over an average of 12.9 postoperative years (obviously Grade II original resections). When Barber *et al.*[1] analyzed 32 studies, involving 896 patients with meningiomas, those undergoing Simpson Grade I resections incurred a 14.3% incidence of new postoperative complications/new neurological deficits versus a 3.4% frequency for Grade II resections (3.4%). Of interest, however, there were no statistically significant differences in tumor recurrence rates over the average follow-up of 95.4 ± 53.7 months between the two techniques.

CONCLUSION

The Saito technique proved to be a safe and effective method for achieving gross total resection of an anterior-based lumbar spinal benign meningioma.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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