



Original Article

Long-term recurrence after surgery for schwannoma of the cauda equina

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ABSTRACT

Background: Cauda equina tumors are rare primary spinal tumors. Histologically, the most common tumor arising from the cauda equina is a schwannoma. However, little is known about the long-term postoperative outcomes of cauda equina schwannoma. Here, we reviewed the median-to-long-term postoperative outcomes of eight of our own patients with schwannomas of the cauda equina.

Methods: Between 2007 and 2020, we, retrospectively, reviewed eight patients with cauda equina schwannomas (CESs) undergoing nine operations at our institution. There were five males and three females averaging 56.5 years of age who were followed for over 40 postoperative months. The study included assessment of the following variables: the modified McCormick scale, tumor size, location, extent of resection, treatment of the tumor involving nerve roots, and postoperative observational follow-up.

Results: Gross-total resection was achieved in all eight patients; none received adjuvant therapy. The involved nerve roots were completely sacrificed in seven patients and partially resected in one. During a median follow-up of 108 months, only one patient sustained a tumor recurrence 164 months following the index surgery.

Conclusion: CESs may recur more than 10 years after the original surgery. Radical resection of the tumor, including complete removal of the involved nerve root during the index surgery, and long-term postoperative follow-up is, therefore, essential.

Keywords: Cauda equina schwannoma, Median-to-long-term outcome, Recurrence, Surgery

INTRODUCTION

Cauda equina schwannomas (CESs) are rare benign tumors that typically precipitate cauda equina syndromes characterized by low back pain, lower extremity sensory/motor disturbances, gait imbalance, and/or bladder/bowel dysfunction. Large or symptomatic CES often warrant surgical resection, but currently, there is no clear role for adjuvant therapy.^[10] To limit tumor recurrence, CES surgery should include initial gross-total tumor removal with sacrifice of the involved nerve root performed utilizing intraoperative electrophysiological monitoring (i.e., to reduce neurological perioperative/postoperative morbidity). Here, we reviewed eight patients who originally presented with cauda equina syndrome attributed to schwannomas to determine the median-to-long-term postoperative recurrence rates and time to recurrence over the median follow-up duration of 108 months.

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MATERIALS AND METHODS

From 2007 to 2012, we, retrospectively, evaluated eight patients who originally presented with cauda equina syndrome due to schwannomas (CES). Our analysis specifically included assessment of their median-to-long-term postoperative incidence and time to recurrence. All tumors were the WHO grade 1, and all were followed for >40 months after the index surgery. We evaluated the following variables: preoperative neurologic/radiologic findings, modified McCormick scales, extent of resection of the tumor and the tumor-involved nerve root, the use of intraoperative electromyography (i.e., last three cases), and postoperative observational time. Surgery included microsurgical laminotomies (i.e., for the first five cases) and laminectomies (i.e., for the last three cases). All patients underwent postoperative lumbar magnetic resonance imaging (MRI) repeated every 6–12 months over a median follow-up duration of 108 months.

Preoperative data in eight cases

Preoperative symptoms in all eight patients included: low back, buttock, and lower extremity pain, and/or numbness [Table 1]. The mean preoperative modified McCormick scale score was 1.75. On MR studies, the mean tumor size was 25.4 mm, and most tumors were located between the L2-4 levels; one patient had an intratumoral cyst.

RESULTS

Although gross-total resection (GTR) was accomplished in eight patients, the tumor-involved nerve roots were fully resected in seven, but just partially removed in one. Postoperatively, two patients exhibited transient and mild motor weakness of the lower extremities. After a median postoperative follow-up time of 108 months for all eight patients, only one patient experienced a tumor recurrence at 164 postoperative months.

Single case report

A 29-year-old woman with low back pain and numbness of both lower extremities had an original MRI demonstrating a cauda equina tumor at the L2–L4 levels measuring 55 mm in diameter with rim-enhancing cyst [Figures 1a and b]. During an osteoplastic L2-4 laminotomy, the tumor-involved nerve roots were sacrificed; the pathologic diagnosis was schwannoma (the WHO grade 1). The postoperative lumbar MRI demonstrated no residual tumor, and she was discharged neurologically intact [Figures 1c and d]. The patient was followed with a gadolinium-enhanced MR scans every 6 months. She was tumor free for 2 years, but was then lost to follow-up. Over 13 years later, she returned with a

Table 1: Clinical summary of patients.

S. No.	Age	Sex	Preoperative McCormick Scale	Main Preoperative Symptoms	Tumor size (mm)	Tumor location	Cyst formation	Extent of resection	Postoperative follow-up time (months)	Recurrence	Intraoperative EMG monitoring	Involved nerve root
1.	29	F	II	Bil. LEs numbness	55	L2-4	+	GTR	164	+	-	Sacrificed
2.	75	M	I	Rt. LE pain	25	L4-5	-	GTR	175	-	-	Sacrificed
3.	49	M	I	Bil. LEs numbness	33	L2-3	-	GTR	41	-	-	Sacrificed
4.	60	M	II	Rt. buttock/thigh pain/numbness	21	L3	-	GTR	119	-	-	Partially resected
5.	37	M	I	Bil. LEs pain	22	L4	-	GTR	101	-	-	Sacrificed
6.	78	F	III	Bil. LEs motor/sensory disturbance	15	L3	-	GTR	57	-	+	Sacrificed
7.	56	F	I	Low back pain	18	L1-2	-	GTR	44	-	+	Sacrificed
8.	68	M	III	Bil. buttock pain	14	L1-2	-	GTR	115	-	+	Sacrificed

Preop: Preoperative, Bil: bilateral, LE: lower extremity, GTR: gross-total resection, Postop: postoperative, EMG: electromyography

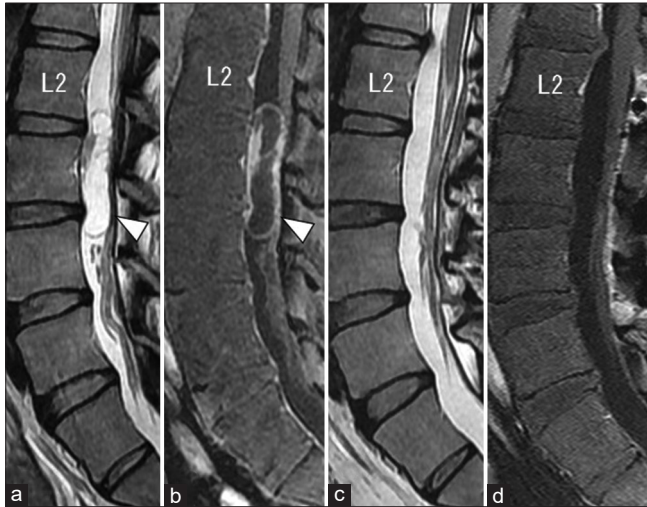


Figure 1: The mid-sagittal view of lumbar MR images before (a and b) and after (c and d) the first surgery. Preoperative T2-weighted (a) and Gd-enhanced T1-weighted (b) images demonstrating intradural cystic tumors at the L2-4 level (white arrowhead). Postoperative T2-weighted (a) and Gd-enhanced T1-weighted (b) images showing no residual tumor.

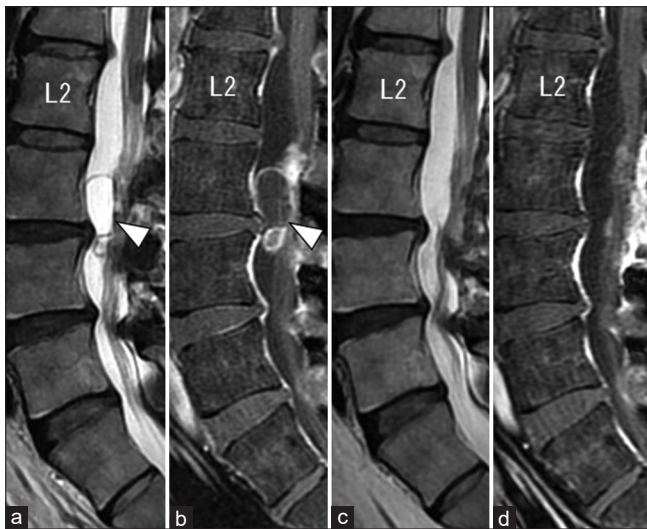


Figure 2: The mid-sagittal view of lumbar MR images before (a, b) and after (c, d) the second surgery. T2-weighted (a) and Gd-enhanced T1-weighted (b) images showing tumor recurrence at the levels of L3-4 (white arrowhead). Postoperative T2-weighted (c) and Gd-enhanced T1-weighted (d) images showing the total removal of the recurrent tumor.

cauda equina syndrome/compression due to a massive L3–L4 recurrent MR-documented CES (i.e., intradural cystic lesion) [Figures 2a and b]. Despite marked adhesions to multiple nerve roots, the tumor was fully excised [Figures 2c and d]. The pathologic diagnosis of the specimen obtained from the second surgery was unchanged: again, a WHO Grade 1 schwannoma with a Ki-67 labeling index of <5% [Figure 3].

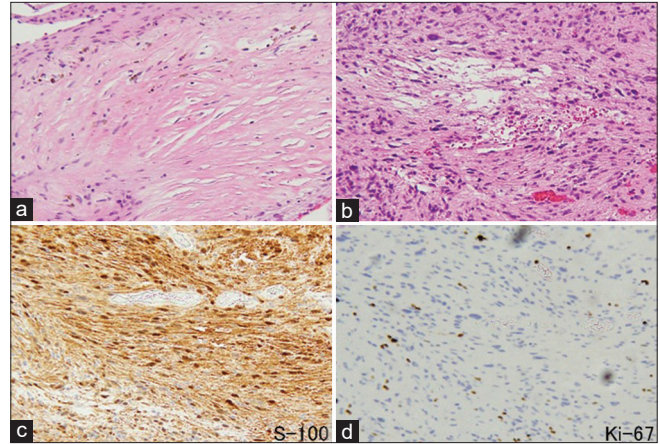


Figure 3: Histopathologic examination of the recurrent tumor. Hematoxylin and eosin-stained sections (a and b) showing spindle cells with myxoid change. Immunohistochemical stains; S-100 (c) and Ki-67 (d).

DISCUSSION

Postoperative delayed recurrence for CES

Spinal schwannomas, accounting for 31–49% of cauda equina tumors in adults, are the third most common primary tumor of the spinal cord, meninges, and cauda equina.^[3,5,12] Further, they are typically well-defined benign tumors that are often treated with surgery alone.^[3,8,12] Nevertheless, there are reports of delayed recurrences of spinal schwannomas [Table 2].^[1,9,12] Wager *et al.* reported total removal in over 99% of patients with CES; a low recurrence rate suggested that imaging beyond 24 months were not required.^[12] Asazuma *et al.* showed that recurrence rate of benign spinal schwannomas was 14 out of 117 patients over a follow-up period of 64 months; they emphasized the benefit of the initial “radical” tumor excision as the extent of excision in all 14 recurrent cases was incomplete or not known.^[1] In our series, all eight patients underwent initial GTR; a recurrence was observed in only one patient 13 years later.

Cause of recurrent CES

Although there are likely several causes for recurrent CES, the most likely factors include: relatively large tumor size, adherence to surrounding nerves resulting in initial partial resections (i.e., attempted preservation of the tumor-involved nerve root thus leaving behind a nidus for recurrence), and cyst formation increasing the risk of “tumor spillage” during the index surgical resection. Lee *et al.* reported that triggered electromyogram and neurophysiological monitoring provide ideal intraoperative data for deciding whether or not to sacrifice the rootlet.^[8]

Table 2: Previous reports of recurrence of spinal schwannomas.

	Number of patients	Tumor location	Median postoperative follow-up time (months)	Extent of resection during the index surgery	Number of recurrence
Wager <i>et al.</i> , 2000 ^[12]	114	Cauda equina	NA	GTR was achieved in 99.12%	1 (0.88%): a type I neurofibromatosis patient
Asazuma <i>et al.</i> , 2003 ^[11]	117	Entire spine	64	Incomplete or not known	14 (12%)
Parlak <i>et al.</i> , 2022 ^[9]	50	Entire spine	30	GTR was achieved in 76%	4 (8%)

NA: Not available, GTR: gross-total resection

Adjunctive therapy

There are a few isolated reports regarding the potential efficacy of stereotactic radiosurgery (SRS) for benign spinal tumors.^[2,4,6,7,11] Specifically, Chin *et al.* conducted that a retrospective study of 149 benign spinal tumors, including 39 meningiomas, 26 neurofibromas, and 84 schwannomas, demonstrated that SRS resulted in local control rates of 95% and 88% at 5 and 10 years, respectively.^[2]

CONCLUSION

We present a case series of eight patients with CES, one of whom experienced recurrence more than 13 years after surgery. This finding should suggest that longer-term follow-up for over 10 years may be necessary to detect recurrent CES.

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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