ISSN: 3068-918X
Journal of Neuro and Oncology Research

ATHENAEUM SCIENTIFIC PUBLISHERS

Review Article

Sacral Melanotic Schwannoma: A Systematic Review of the Literature

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Citation: Iunes EA, et al. Sacral Melanotic Schwannoma: A Systematic Review of the Literature. J Neuro Onco Res. 2026;6(1):1-22.
https://doi.org/10.46889/JNOR.2026.6107

Received Date: 28-01-2026
Accepted Date: 16-02-2026
Published Date: 23-02-2026

Abstract

Background: Melanotic schwannoma (MS) is a rare variant of nerve sheath tumor, accounting for less than 1% of all primary schwannomas. Although historically considered benign, MS has demonstrated unpredictable behavior.

Methodology: A comprehensive search was performed in the PubMed and Embase databases to identify relevant case reports and case series on spinal melanotic schwannoma. Study selection was based on predefined inclusion criteria. The methodological quality and risk of bias of the included reports were assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Case Reports.

Results: Our review identified 70 articles describing a total of 118 patients with spinal melanotic schwannoma. MS primarily affects adult individuals, with no apparent sex predilection. The lumbosacral region was the most commonly affected spinal segment. Gross total resection was the preferred treatment in the majority of cases. Adjuvant therapies were inconsistently applied. Recurrence occurred in a significant proportion of patients and mortality was reported despite aggressive treatment in some cases.

Conclusion: Melanotic schwannoma of the spine is a rare tumor with potentially more aggressive behavior than previously thought. Gross total resection remains the mainstay of treatment.

Keywords: Melanotic Schwannoma; Spinal Schwannoma; Intradural Extramedullary Tumor; Spinal Neoplasms; Sacral Tumors; Nerve Sheath Tumors; Malignant Peripheral Nerve Sheath Tumor

Introduction

Melanotic Schwannoma (MS) is a rare variant of nerve sheath tumor composed of melanin-producing neoplastic Schwann cells. First described by Millar in 1932, MS accounts for less than 1% of all primary schwannomas [1-3]. Unlike conventional schwannomas, its biological behavior remains incompletely understood. A subset of MS cases occurs in association with Carney complex, a rare autosomal dominant syndrome characterized by cutaneous pigmentation, cardiac and extracardiac myxomas, endocrine tumors and psammomatous melanotic schwannomas. This association was first described by Carney in 1990 [4].

Approximately 200 cases of malignant schwannoma have been reported to date. These tumors most often arise from spinal nerve roots, particularly in the lumbosacral and thoracic regions, with rarer involvement of the sympathetic chain, cranial nerves, peripheral nerves and the gastrointestinal tract. Clinical presentation typically consists of localized pain related to tumor location [2,5,6].

Historically considered benign, MS is now recognized to have unpredictable and potentially aggressive behavior, with several reports documenting local recurrence, distant metastasis and even disease-related mortality [7,8].

There is currently no standardized treatment protocol for MS. Most authors recommend Gross Total Resection (GTR) as the primary treatment, aiming to reduce the risk of recurrence or progression [1,8-14]. The role of adjuvant therapy remains controversial, with some centers offering radiotherapy or chemotherapy in selected cases, particularly when complete resection is not achieved or in cases of recurrence.

In this review, we present an illustrative case of sacral melanotic schwannoma in a young woman, managed with surgical resection and adjuvant radiotherapy, followed by over four years of recurrence-free follow-up. In addition, we conducted a systematic review of the literature to summarize the clinical features, treatment strategies and outcomes of spinal MS, aiming to contribute to a better understanding of this rare entity.

Melanotic schwannomas are rare nerve sheath tumors with more aggressive behavior than conventional schwannomas. Although diagnosis is challenging, characteristic MRI features such as T1 hyperintensity and early enhancement can help differentiate them. This study provides the most comprehensive review to date, highlighting key clinical, radiological and pathological findings.

Methodology

Systematic Review

This systematic review followed PRISMA guidelines. We included original reports of spinal melanotic schwannoma with histopathological confirmation, encompassing case reports, case series and cohort studies. Review articles, letters, conference abstracts without data and animal studies were excluded.

A comprehensive search of PubMed and Embase was performed up to June 2024, with no language or date restrictions. Reference lists were also screened manually. Two reviewers independently selected studies, extracted data and resolved disagreements by consensus.

Extracted variables included demographics, tumor characteristics, treatment, neurological outcomes, recurrence and follow-up duration. Study quality was assessed using the Joanna Briggs Institute checklist, with all included cases scoring 7-8. Due to heterogeneity, a narrative synthesis was performed rather than a meta-analysis.

Results

Illustrative Case

History and Presentation

A 21-year-old woman presented with a two-year history of low back pain radiating to the left lower limb, corresponding to the S1 dermatome. She had no relevant family history or clinical signs suggestive of Carney complex. Electromyoneurography demonstrated mild radiculopathy involving the left S1 nerve root.

Initial Magnetic Resonance Imaging (MRI) revealed a nodular intradural extramedullary lesion located at the left S1 foramen, with associated remodeling of the adjacent sacral bone and evidence of necrotic and hemorrhagic components. The lesion appeared isointense on T1-weighted sequences and hypointense on T2-weighted sequences (Fig. 1-4). These imaging features were consistent with a peripheral nerve sheath tumor. Despite minimal clinical symptoms, subsequent MRI demonstrated progressive growth of the lesion, reaching dimensions of 3.5 × 3.3 × 1.8 cm. Given the documented enlargement, surgical intervention was indicated (Fig. S1).

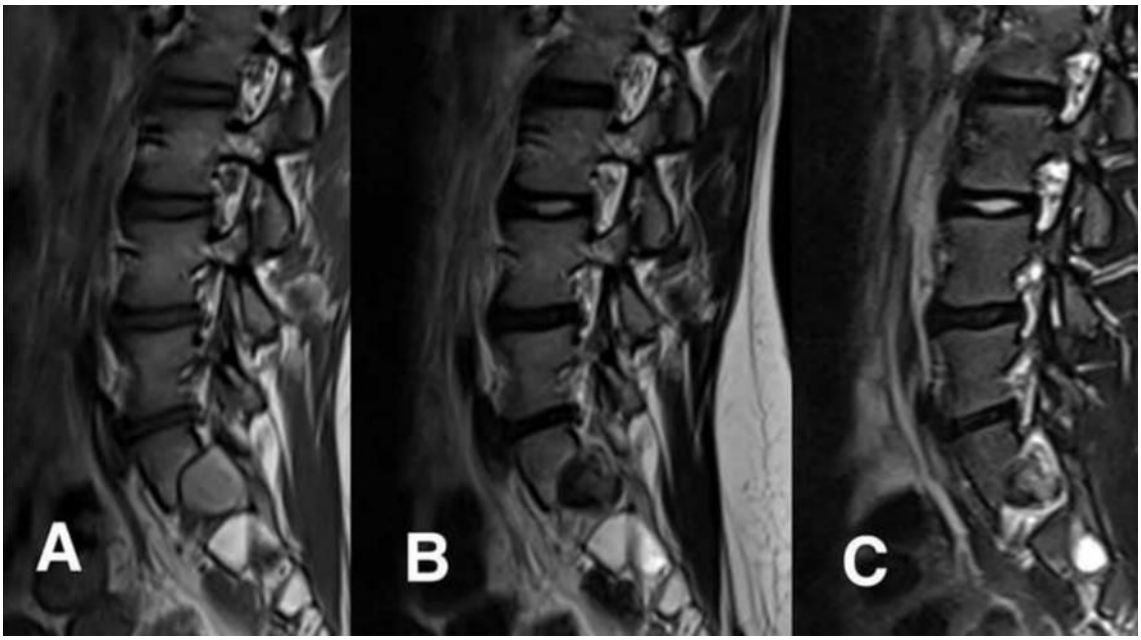

Figure 1: Sagittal T1, T2 and STIR-weighted (A, B and C) images showing the tumor located at S1, measuring 3.5 x 3.3 x 1.8 cm.

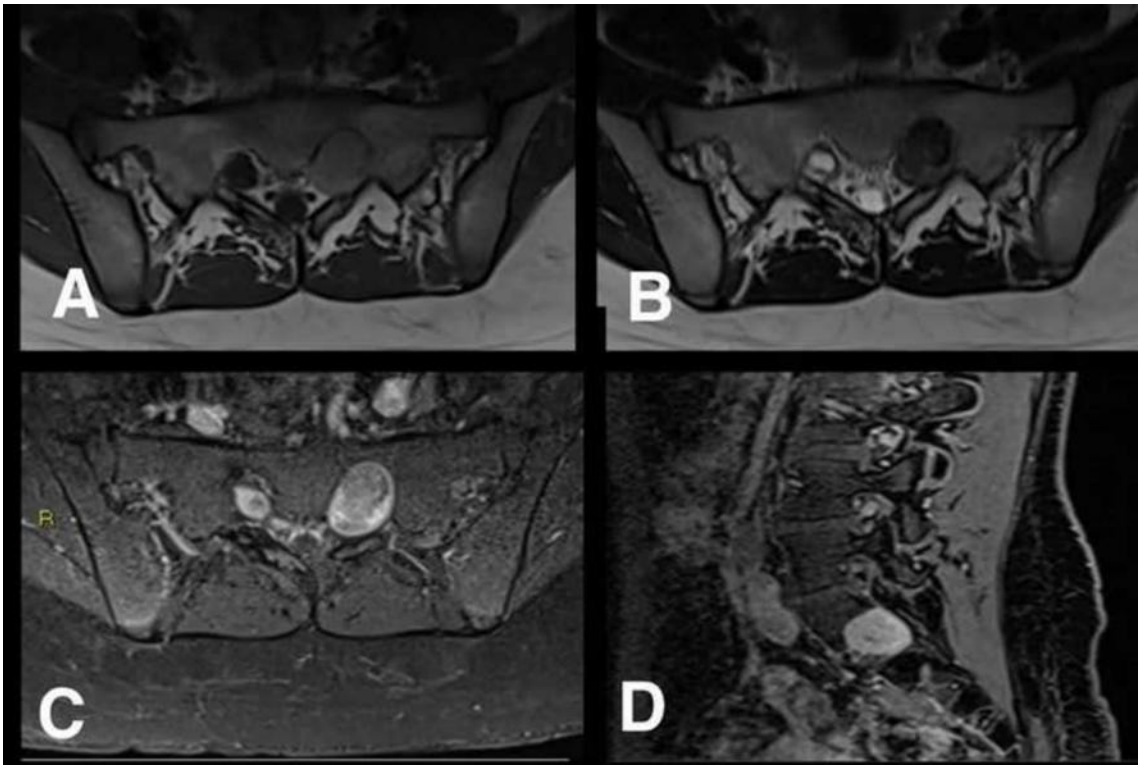

Figure 2: Axial T1 (A), T2 (B) and axial and sagittal T1-fat suppression postcontrast (C and D) weighted image disclosing an oval lesion with hypersignal T1.

Surgical Intervention

The patient underwent an L5-S1 hemilaminectomy via a midline incision. Intraoperatively, a dark, hemorrhagic, fibrous tumor was identified and completely removed after subtotal debulking under microscopic visualization. Oncological margins were not pursued as malignancy was not initially suspected. Histopathology revealed epithelioid, spindle-shaped and polygonal cells with prominent nucleoli and abundant melanin. Immunohistochemistry was positive for S100, HMB-45 and Melan-A, with a high Ki-67 index and negative PRKAR1A expression, confirming a malignant melanotic schwannoma.

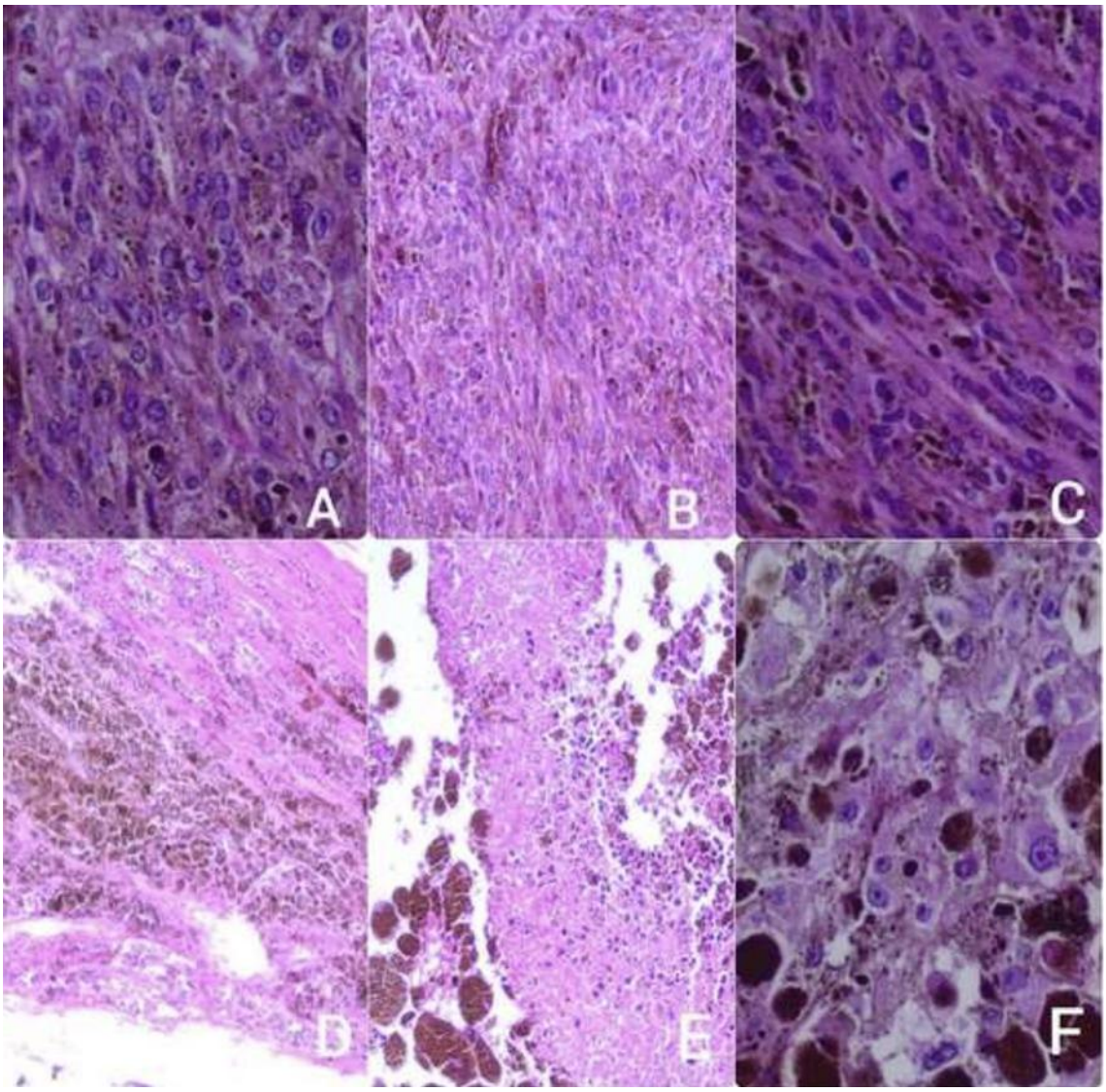

Figure 3: Tumor consisting of epithelioid, spindled shaped or polygonal cells with atypical vesicular nuclei and heavy melanin.

Postoperative Course

Postoperatively, the patient experienced significant pain relief with only mild residual hypoesthesia in the S1 dermatome. She received adjuvant radiotherapy (60 Gy) for local control. Early postoperative MRI showed enhancement at the surgical site, which progressively decreased on annual follow-up scans. At 51 months, the patient remained asymptomatic with no evidence of recurrence or metastasis (Table 1).

Timepoint	Event
-24 months	Onset of low back pain and sciatic pain
-12 months	Initial imaging and diagnosis of S1 lesion
0 months	Surgery performed
<1 month	Histopathology confirms malignant melanotic schwannoma
4 months	Radiotherapy completed
51 months	Serial imaging follow-up (MRI) – no recurrence

Table 1: Summary of the clinical course.

Based on a comprehensive search of two electronic databases (PubMed and Embase), our initial screening identified a total of 232 articles, of which 70 (the references are available in the appendix section) met all predefined inclusion and exclusion criteria, collectively reporting on 118 individual patients (PRISMA available in Supplementary material). To the best of our knowledge, this constitutes the most comprehensive literature review of spinal melanotic schwannoma cases published to date.

The literature data review is summarized in a Table available in the supplementary material section. The average age at diagnosis was 43.6 (11-84) years, with an almost equal sex distribution: 60 males and 58 females. The most commonly affected spinal region was the lumbosacral segment (n = 52), followed by the thoracic (n = 39) and cervical (n = 28) regions. Clinical presentation typically involved localized pain and neurological symptoms (Table 2).

Characteristic	*All patients (n=118)*
Age (mean)	42,6
Sex, male	60
Localization	28 cervical / 39 thoracic / 52 Lombo-sacral
Follow-up (months - mean)	38,3
Neurological outcome after surgery	11 worsening / 38 stable or improvement
Recurrence	37
Death	21

Table 2: Key features extracted from the included studies.

Gross total resection was the most frequently reported surgical approach (n = 59). Surgical treatment was performed in the vast majority of cases. When adjuvant therapy was applied, radiotherapy was the most commonly used modality (n = 31). In total, 33 cases received some form of adjuvant therapy (radiotherapy and/or chemotherapy), while 39 studies explicitly reported no adjuvant treatment. In 46 studies, this information was not provided (Table 3).

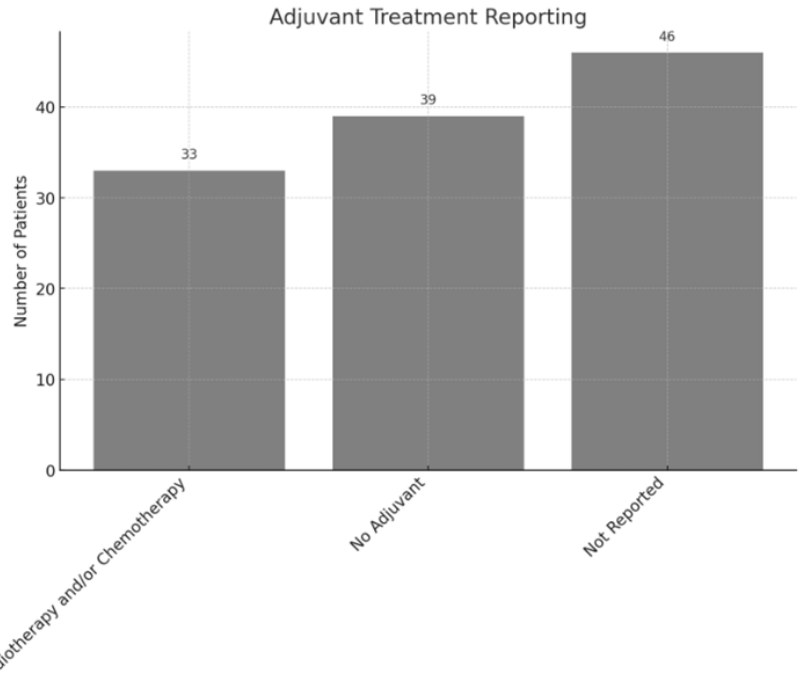

Figure 4: Adjuvant therapy for melanotic schwannoma of the spine.

Parameter	Findings
Neurological outcome	Favorable (improvement or stabilization) in 38 patients
Tumor recurrence	Documented in 37 patients
Recurrence-free	58 patients
Recurrence data unavailable	23 patients
Studies reporting follow-up	89 studies
Follow-up duration	2-300 months
Mean follow-up	38.3 months
Median follow-up	18 months
Mortality	21 patients
Median time to death	12 months postoperatively

Table 3: Summary of clinical outcomes and follow-up data.

Discussion

Melanotic Schwannoma (MS) is a rare nerve sheath tumor characterized by melanin-producing Schwann cells, first described by Millar in 193212. It is considered a distinct entity due to its potential for aggressive behavior, including local recurrence and distant metastasis. MS may occur sporadically or in association with Carney complex; in our review, most cases were sporadic. Although it can affect both young and older adults, no pediatric cases were identified, underscoring its extreme rarity in this age group.

MS and conventional schwannomas share clinical and anatomical features, including slow growth and nerve root involvement. Both show strong post-contrast enhancement, but MRI signal differences help distinguish them: MS typically presents T1 hyperintensity and T2 iso- or hypointensity due to melanin, unlike conventional schwannomas, which are usually T1 iso-/hypointense and T2 hyperintense [8,13]. Additional features such as hemorrhage, calcifications and Carney complex also support the diagnosis [1,10]. Histopathology and immunohistochemistry (HMB-45, S100 positivity) confirm the diagnosis (Table 4) [1,9,10].

Feature	Conventional Schwannoma	Melanotic Schwannoma
T1-weighted Signal	Hypointense or isointense	Hyperintense due to melanin content
T2-weighted Signal	Hyperintense	Hypointense or isointense (melanin effect)
Contrast Enhancement	Strong, often homogeneous enhancement	Strong, often heterogeneous enhancement
Hemorrhage	Uncommon	More frequent
Melanin pigment	Absent	Present (diagnostic hallmark - T1 hyperintensity)
Association with Carney Complex	No	Yes, especially psammomatous type

Table 4: MRI features- conventional vs. melanotic schwannoma.

Gross Total Resection (GTR) remains the preferred treatment and is associated with lower recurrence and metastasis rates8. The role of adjuvant therapy is unclear and its use varies, though it may be considered in residual or recurrent disease14. Given its unpredictable course, long-term follow-up is essential. Most reported follow-ups were under 25 months, likely underestimating late events. Although once considered benign, growing evidence including the series by Torres-Mora, et al., indicates that melanotic schwannoma carries malignant potential, with disease-related deaths occurring despite gross total resection and

adjuvant therapy, highlighting the uncertainty surrounding its prognosis and optimal treatment [15]. For rare tumors such as melanotic schwannoma, systematic reviews of case reports are essential. The strength of this study is its ability to synthesize dispersed clinical evidence into actionable insights regarding prognosis, recurrence and survival, thereby supporting more informed clinical decision-making (Table S1-4).

Conclusion

Melanotic schwannoma is a rare nerve sheath tumor with a more aggressive biological behavior than traditionally recognized. Gross total resection remains the mainstay of treatment; however, the role of adjuvant therapy remains uncertain and should be individualized. Given the rarity of the disease and the reliance on heterogeneous case reports, current evidence is limited, yet the risk of late recurrence or metastasis supports the need for long-term MRI surveillance. Future multicenter studies and dedicated registries are required to better define prognostic factors and optimize management strategies.

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding Statement

This research did not receive any specific grant from funding agencies in the public, commercial or non-profit sectors.

Acknowledgement

None

Data Availability Statement

Not applicable.

Ethical Statement

The project did not meet the definition of human subject research under the purview of the IRB according to federal regulations and therefore, was exempt.

Informed Consent Statement

Informed consent was taken for this study.

Authors' Contributions

All authors contributed equally to this paper.

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Supplemental Content

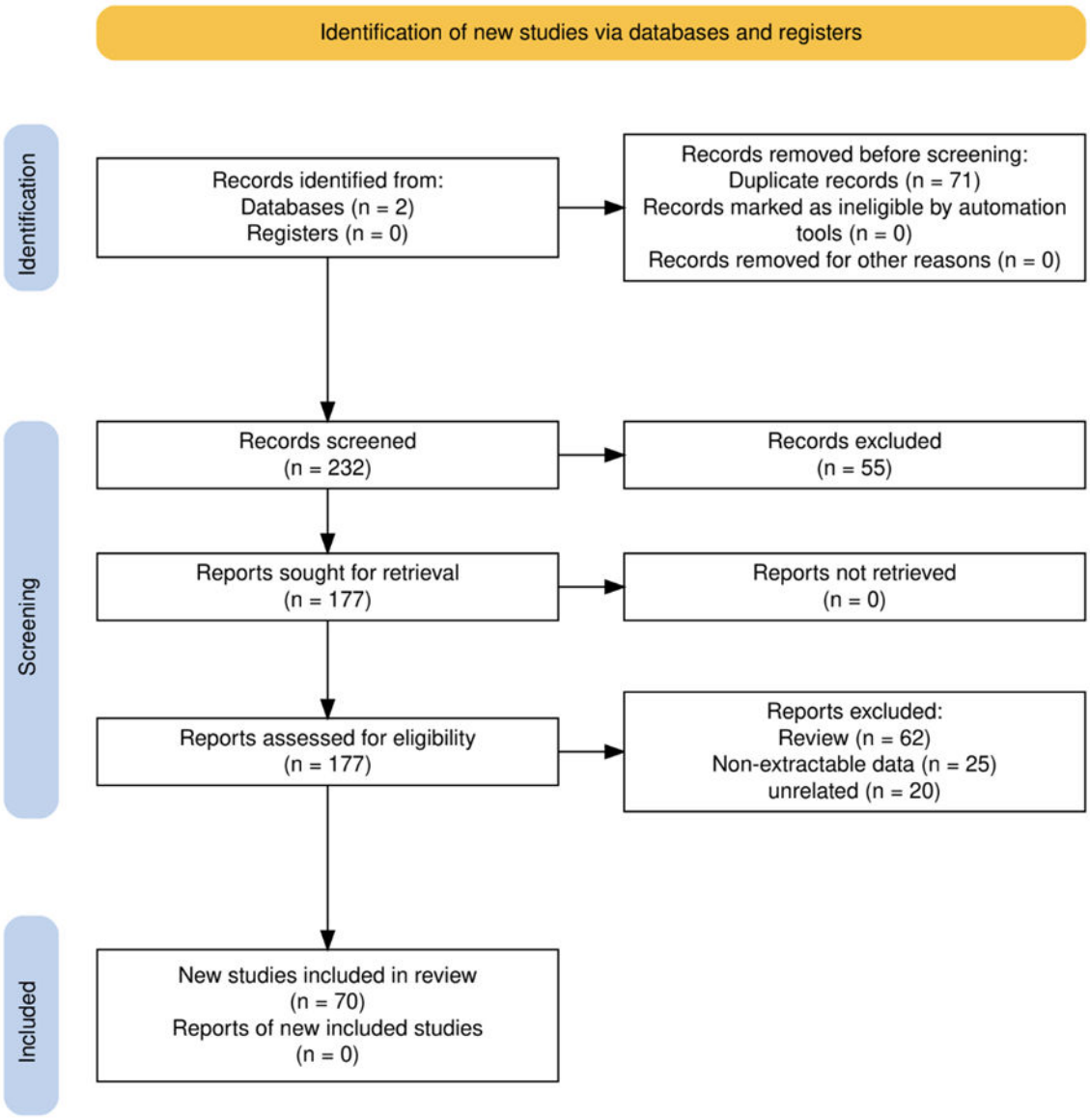

Figure S1: PRISMA flow diagram.

Patient	Authors and year	Age	Sex	Location	Size (mm)	Clinical presentation	Surgery (gross ressection x subtotal x partial x biopsy)	Adjuvant treatment (QTX x RTX x Imunoherapy)	Neurological outcome	Survival rate (months)	Recurrence	Follow-up (months)
1	Yan, et al., 2023[1]	33	M	Sacral (S2)	20x25x20	2 months of low back pain and a half-month of right thigh numbnes	Gross total ressection	RTX	No déficits	Yes	No	18
2	ER, et al., 2007[2]	54	M	Cervical (C0-C1)	20x30x20	2mo neck pain and right arm hypoesthesia, worsening to right hemiparesis	Gross total ressection	No	N/A	Yes	No	24
3	Sahay, et al.,	35	M	Lumbar	14x12	lower back pain and	Subtotal	RTX	No deficits	Yes	No	6

	2020[3]			(L2-L3)		pain in the right knee with weakness for 1.5 months	resection					
4	Sahay, et al., 2020[3]	44	M	Cervical (C1-C2)	N/A	tingling and numbness in both upper limbs	Subtotal resection	No	N/A	Yes	Yes	30
5	Sahay, et al., 2020[3]	35	F	Lumbar (L3)	N/A	progressive left thigh pain	Subtotal resection	RTX and Imunotherapy	N/A	Yes	Yes	36
6	Sahay, et al., 2020[3]	50	F	Cervical (C6)	11x32x20	bilateral lower limb weakness, paraesthesia since past 4 to 5 months and bladder incontinence since 1 week	Subtotal resection	RTX	Stable, no new déficit	Yes	No	N/A
7	Xiang, et al., 2023	60	M	Thoracic (T6-T7)	43x30x61	2-year history of chest and back pain.	Biopsy	No	N/A	N/A	N/A	N/A
8	Cheng, et al., 2017	47	M	Thoracic (T4-T5)	18x21x44	back pain, hypoesthesia below mamiillary level and left-leg weakness that progressively got worse over a period of fourteen months	Subtotal resscetion	No	Worsening legs strength	Yes	Yes	72
9	Hou, et al., 2020	41	F	Cervical (C2-C3)	40x11	8-month history of neck pain and 6-month history of numbness and weakness of the upper extremities.	Gross total ressection	RTX after recurrence	No déficits	Yes	Yes	151
10	Khoo, et al., 2016	36	F	Lumbar-Sacral (L5-S1)	N/A	4-year history of left hip pain, with progressive radiantiion to the left lateral leg and little toe complained of progressive symptoms with new radiation of	Biopsy -> gross total ressection	N/A	N/A	Yes	10 months FO osseous tumour infiltration adjacent to the previous resection site	10
11	Khoo, et al., 2016	20	M	Sacral (S1)	30	4 year low back pain, worse on the left side	Biopsy -> gross total ressection	N/A	N/A	N/A	N/A	N/A
12	Khoo, et al., 2016	46	M	Lumbar (L3)	N/A	2 year of back and left leg pain with intermittent left leg numbness	Gross total ressection	QTX and RTX	N/A	30	Yes	30
13	McGravan et al., 1979	12	M	Thoracic (T2)	6x8	gait disturbance and urinary incontinence	Gross total ressection	No	Mild spastic left leg paresis	Yes	No	60
14	McGravan, et al., 1979	49	F	Cervical-thoracic (C7-T1)	70x50	3-monts pain right forearm and fingers. Atrophy and paresis intrinsic msucules right hand	Gross total ressection	No	No déficits	Yes	No	24
15	Hoover, et al., 2012	62	F	Thoracic (T12)	12x10x11	several years pain in thighs	Gross total ressection	No	diffuse mild corticospinal weakness in the lower extremities bilaterally with spasticity in	Yes	No	10

									the right lower extremity. Sensory deficits in the lower extremities resulting in sensory ataxia			
16	Paris, et at., 1979	49	F	Cervico-thoracic (C7-T1)	60x45x22	2-year pain in right arm	Gross total ressection	RTX	No déficits	Yes	No	48
17	Sun, et al., 2023	55	F	Lumbar-Sacral (L5-S1)	22x19	right waist to hip swelling pain	Gross total ressection	RTX	No déficits	Yes	No	12
18	Hall, et al., 2022	18	F	Sacral (S1-S2)	29x28	progressive lower back pain and right lower extremity radicular pain for several years	Subtotal -> gross total ressection	RTX	No déficits	Yes	No	30
19	Tawk, et al., 2005	61	M	Thoracic (T7-T9)	N/A	2-year history of worsening thoracic back pain and weakness of the lower extremities	Gross total ressection	RTX and QTX	motor function improved progressively on the right side. Remained weak on the left side and retained a sensory level at T8 with paresthesia and numbness	11	Yes	11
20	Santaguida, et al., 2004	35	M	Cervical (C4-C5)	N/A	neck pain that radiated to his right subscapular region. His symptoms worsened progressively, developed right C5 paresthesia accompanied by clonus of his right foot and ankle and gait dysfunction	Gross total ressection	RTX after recurrence	Symptons improvement	Yes	Yes	48
21	Güzel E, et al., 2016	36	M	Lumbar-Sacral (L5-S1)	20x20x15	Low back pain radiating the right leg, with progressive leg weakness and numbness	Subtotal ressection	No	Improvement pain and weakness	Yes	No	6
22	McCann and Hain, 2023	40	M	Thoracic (T8-T11)	31x11	2-month history of progressive bilateral leg weakness and pain radiated bilaterally to the lower extremities	Gross total ressection	QTX	Worsening legs strength and sensibility. Improvement back pain	Yes	No	3
23	Acciarri, et al., 1999	44	F	Thoracic (T2-T3)	30	10-year history of numbness and paraesthesiae of both lower lim bs and weakness to the right	Gross total ressection	No	Improvement legs strength and sensibility	Yes	No	4

						leg						
24	Mouchaty, et al., 2008	56	F	Thoracic-Lumbar (T12-L1)	30-40	Legs weakness	Gross total ressection	No	Improvement legs strength	Yes	No	12
25	Zhao, et al., 2011	46	M	Cervical (C6-C7)	17x21x15	pain and distension in his neck for 2 years and numbness of his left hand for 1 year;	Gross total ressection	RTX	No deficits	Yes	No	16
26	Li and Dai, 2019	61	F	Lumbar (L1)	16x45	progressive weakness of the lower limbs and increasing pain and numbness around the left lower extremity 3 years prior to admission	Gross total ressection	N/A	N/A	N/A	N/A	N/A
27	De Cerchio, et al., 2006	53	M	Thoracic (T9-T10)	25	pain in his right chest and upper limb	Gross total ressection	No	Pain improvement	Yes	No	24
28	Marton, et al., 2007	30	F	Cervical (C2-C3)	20	right cervical pain and cervical muscle contractures for six months. mild raight arm paresis	Gross total ressection	No	Pain improvement	Yes	Yes	12
29	Solomou, et al., 2020	45	F	Cervical (C6)	N/A	one-year history of insidious neck pain radiating to the shoulder girdle, left arm and thumb, with associated paraesthesia in the same distribution	Subtotal	RTX and Imunotherapy	Pain improvement	15	Yes	15
30	Takatori, et al., 2020	39	M	Lumbar (L4)	N/A	low back pain and numbness of the left leg	Subtotal	RTX	Pain and numbness improvement	22	Yes	22
31	Hu and Wang, 2018	40	M	Cervical (C1-C2)	15x10	left arm numbness that gradually worsened	Partial	No	left arm numbness partially subsided	Yes	No	2
32	Biju, et al., 2020	38	F	Lumbar-Sacral (L5-S1)	N/A	sudden-onset dull ache in her lower back region followed by sharp radicular pain radiating down from her left gluteal region to the foot	Gross total ressection	No	recovered well with improvement in both her back and radicular pain	Yes	No	N/A
33	Gregorios, et al., 1982	45	F	Thoracic (T2)	30x30	insidious onset of numbness and tingling over her lower abdomen and upper legs; later developed urinary urgence	Subtotal	No	markedly paraparetic, presumably because of spinal cord manipulation	N/A	N/A	N/A
34	Soyland, et al., 2021	53	M	Thoracic (T8-T9)	44x21x20	2-day history of sudden-onset left chest pain radiating to his left back	Gross total ressection	No	doing well other than some persisting incisional pain	Yes	No	6
35	Erlandson, 1985	36	M	Lumbar-Sacral (L5-S1)	20x10x5	dull aching pain in the left hip and left lower back in addition to	Gross total ressection	No	neurologic impairment improved	Yes	No	92

						paresthesias along the lateral aspect of the left foot of 3 years duration.						
36	Li and Chen, 2015	62	M	Thoracic (T7)	50x30x20	routine physical examination	Gross total ressection	No	Stable	Yes	No	30
37	Mohamed, et al., 2014	43	M	Thoracic (T9-T10)	26x12	left-leg weakness that gradually got worse	Gross total ressection		his power in his right leg had reduced to 3/5 throughout all muscle groups and he had developed urinary incontinence requiring catheterisation	Yes	No	3
38	Chandran, et al., 2018	25	M	Cervical (C2)	N/A	nonspecific neck pain	Gross total ressection	No	N/A	Yes	No	60
39	Bakan, et al., 2015	31	F	Thoracic (T4-T5)	25	back pain	Gross total ressection	No	uneventfull	Yes	No	6
40	Alamer and Tampieri, 2019	45	F	Thoracic (T5-T6)	N/A	back pain	Gross total ressection	No	N/A	Yes	No	23
41	Alamer and Tampieri, 2019	54	F	Sacral (S2-S3)	N/A	back pain	Gross total ressection	No	N/A	Yes	No	15
42	Arvanitis, 2010	36	M	Lumbar (L3)	178x170x97	increasing back pain radiated to the right side of the abdomen and a recent 20 pound weight loss; right leg weakness	Partial	N/A	N/A	N/A	N/A	N/A
43	Chen and Gu, 2015	47	M	Thoracic (T2-T4)	45x25x15	pain in chest and back; numbness and weakness in lower extremities; occurrence of urinary retention	Gross total ressection	No	sensory disturbances decreased, strength improvement; deep and shallow sensation in both lower extremities was normal; urinary retention remarkably improved	Yes	No	6
44	Faria, et al., 2013	32	F	Cervical (C4-C5)	37x30x16	cervical pain and left arm progressive weakness	Gross total ressection	RTX / QTX and Radiosurgery after recurrency	a patent deficit of left shoulder abduction and paresthesia persist related to the nervous section.	9	Yes	9
45	Yokota, et al., 2012	64	M	Cervical (C7)	45x22x17	3-year history of sensory changes in his left arm and a 1-month history of gait disturbance	Subtotal	RTX after recurrence	symptoms were remarkably improved	12	Yes	12

46	Bosman, et al., 1995	43	M	Lumbar (L4-L5)	N/A	posterior leg pain and hypostenia of the left lower limb	Gross total ressection	N/A	the patient had overcome neurologic impairment	N/A	N/A	N/A
47	Shabani, et al., 2015	54	M	Cervical (C5)	21x19x15	Incidental finding -> 18 month follow-up with significant pain radiating from the left cervical region into the left thumb and index finger.	Gross total ressection	No	N/A	7	Yes	7
48	Solomon, et al., 1987	69	M	Cervical (C0-C3)	N/A	loss of pain and temperature sensation in distal left leg; weakness of right arm with hand atrophy; weaknesse of left leg; decreased pain and temperature sensation in left upper extremity	Gross total ressection	N/A	increased difficulty with vibratory and position sensation on the right side of the body	N/A	N/A	N/A
49	Terry, et al., 2022	48	F	Sacral (S2)	90x85x70	severe lower back and right buttock pain with right thigh numbness over a period of one year; difficulty urinating and defecating.	Biopsy -> Gross total ressection	QTX and RTX	dramatic improvement in pain	18	Yes	18
50	Vallat-Decouvelaere, et al., 1999	35	F	Lumbar (L3-L5)	N/A	Lumbar and sciatic pain for 3 years	Gross total ressection	N/A	N/A	72	Yes	72
51	Vallat-Decouvelaere, et al., 1999	27	M	Lumbar (L5)	N/A	Lumbar and left sciatic pain	Gross total ressection	N/A	N/A	72	No	72
52	Vallat-Decouvelaere et al., 1999	34	M	Cervical (C1)	N/A	Cervical pain for 1 year, right sensitive deficit, left motor deficit	Partial	N/A	N/A	Yes	No	84
53	Vallat-Decouvelaere et al., 1999	45	F	Thoracic (T6)	N/A	Dorsal pain for 1 year	Gross total ressection	N/A	N/A	36	No	36
54	Vallat-Decouvelaere, et al., 1999	41	F	Sacral (S1)	N/A	Dorsal pain and sciatic pain for 4 years	Partial	N/A	N/A	Yes	No	72
55	Buhl, et al., 2004	28	M	Lumbar-Sacral (L5-S1)	60x50	4 weeks of low back ache and sciatic pain on the right side for S1.	Gross total ressection	No	paresis of the S1 root on the right side and hypaesthesia	Yes	No	30
56	Marchese and McDonald, 1990	72	F	Cervical (C4-C6)	20x15	more than 20 years for progressive lower extremity weakness; burning dysesthesiae in both feet and having difficulty controlling her bladder and bowels, progressive weakness on upper limbs	Subtotal	N/A	uneventful recovery and regained significant function in both upper extremities	N/A	N/A	N/A
57	Grosshans, et al., 2020	23	M	Cervical (C2-C3)	N/A	Cervical myelopathy	Gross total ressection	RTX after recurrence	N/A	Yes	Yes	180
58	Grosshans, et	67	M	Thoracic	N/A	Thoracic myelopathy	Subtotal	RTX	N/A	Yes	No	14

	al., 2020			(T8-T9)								
59	Grosshans, et al., 2020	43	F	Lumbar (L4-L5)	N/A	Radiculopathy	Subtotal	No	N/A	Yes	No	2
60	Shen, et al., 2021	29	F	Lumbar (L2-L3)	43x31	1-day history of backache; mild weakness and hypermyotonia in the right leg	Biopsy	QTX	recovered well	Yes	No	12
61	Shields, et al., 2011	65	F	Thoracic (T6-T8)	30x20x15	history of mid-thoracic spinal pain.	Partial	RTX	N/A	8	Yes	8
62	Shields, et al., 2011	33	M	Lumbar-Sacral (L5-S1)	N/A	low back pain and right L5 radiculopathy.	Gross total ressection	RTX and QTX after recurrence	N/A	42	Yes	42
63	Ng and Munoz, 2016	20	F	Sacral (S1)	N/A	history of back pain radiating down the right leg into the foot leading to numbness in the S1 distribution.	Partial	RTX	N/A	Yes	No	12
64	Mennemeyer et al., 1979	25	M	Thoracic (T7)	25	progressive numbness in left leg	Gross total ressection	No	completely recovered	Yes	No	24
65	Mennemeyer, et al., 1979	23	F	Thoracic-Lumbar (T10-L2)	25	weakness of both lower limbs with back pain	Gross total ressection	RTX after recurrence	completely recovered	Yes	Yes	61
66	Mennemeyer, et al., 1979	36	M	Sacral (S1)	10x15x20	low back pain with radiation down the posterior aspect of left leg	Gross total ressection	No	completely recovered	Yes	No	9
67	Zaninovich, et al., 2019	22	M	Thoracic (T9-T11)	61	intermittent back pain becoming more frequent until it worsened and he developed paraparesis, that became paraplegia, with complete anesthesia below the umbilicus, absent lower extremity deep tendon reflexes, rectal tone absent and acute urinary retention with priapism.	Subtotal	RTX after recurrence	remained paraplegic with T11 sensory level; bowel function had returned to normal, but bladder function did not return	Yes	Yes	33
68	Torres-Mora, et al., 2014	21	F	Cervical (C7)	N/A	N/A	N/A	N/A	N/A	Yes	No	300
69	Torres-Mora, et al., 2014	66	F	Thoracic (T10)	N/A	N/A	N/A	N/A	N/A	Yes	Yes	6
70	Torres-Mora, et al., 2014	23	F	Lumbar (L4)	25X15X5	N/A	N/A	N/A	N/A	Yes	No	44
71	Torres-Mora, et al., 2014	67	F	Thoracic (T10)	25	N/A	N/A	N/A	N/A	5	No	5
72	Torres-Mora, et al., 2014	44	F	Thoracic (T5-T6)	N/A	N/A	N/A	N/A	N/A	36	Yes	36
73	Torres-Mora, et al., 2014	39	M	Thoracic (T3)	30	N/A	N/A	N/A	N/A	Yes	Yes	108
74	Torres-Mora, et al., 2014	47	M	Lumbar (L3-L4)	14X13	N/A	N/A	N/A	N/A	10	No	10
75	Torres-Mora, et al., 2014	61	M	Thoracic (T6-T8)	60X40	N/A	N/A	N/A	N/A	10	No	10
76	Torres-Mora, et al., 2014	47	M	Cervical (C5)	15X14	N/A	N/A	N/A	N/A	Yes	Yes	48

77	Torres-Mora, et al., 2014	62	F	Thoracic (T11)	14	N/A	N/A	N/A	N/A	Yes	No	25
78	Torres-Mora, et al., 2014	27	M	Lumbar (L2-L3)	N/A	N/A	N/A	N/A	N/A	Yes	Yes	128
79	Torres-Mora, et al., 2014	69	M	Sacral	N/A	N/A	N/A	N/A	N/A	Yes	No	1
80	Torres-Mora, et al., 2014	32	F	Lumbar-Sacral (L5-S1)	25	N/A	N/A	N/A	N/A	Yes	No	18
81	Torres-Mora, et al., 2014	32	F	Cervical (C2)	28X11	N/A	N/A	N/A	N/A	Yes	Yes	72
82	Torres-Mora, et al., 2014	32	M	Cervical (C2)	31X20X13	N/A	N/A	N/A	N/A	12	No	12
83	Torres-Mora, et al., 2014	25	F	Sacral	70	N/A	N/A	N/A	N/A	6	Yes	6
84	Torres-Mora, et al., 2014	62	F	Cauda Equina	N/A	N/A	N/A	N/A	N/A	Yes	No	168
85	Torres-Mora, et al., 2014	19	M	Sacral (S1)	N/A	N/A	N/A	N/A	N/A	Yes	No	7
86	Torres-Mora, et al., 2014	30	M	Sacral (S1)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
87	Torres-Mora, et al., 2014	17	F	Sacral (S1)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
88	Torres-Mora, et al., 2014	63	M	Sacral	50X35X10	N/A	N/A	N/A	N/A	N/A	N/A	N/A
89	Torres-Mora, et al., 2014	40	F	Lumbar (L3-L4)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
90	Torres-Mora, et al., 2014	52	F	Thoracic-Lumbar	19X15	N/A	N/A	N/A	N/A	N/A	N/A	N/A
91	Torres-Mora, et al., 2014	28	M	Thoracic (T10)	30	N/A	N/A	N/A	N/A	N/A	N/A	N/A
92	Torres-Mora, et al., 2014	84	F	Conus Medullaris	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
93	Torres-Mora, et al., 2014	45	M	Thoracic (T7)	20X8X4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
94	Torres-Mora, et al., 2014	75	M	Lumbar (L2)	35X20X15	N/A	N/A	N/A	N/A	N/A	N/A	N/A
95	Torres-Mora, et al., 2014	47	F	Thoracic (T12)	18X17X11	N/A	N/A	N/A	N/A	N/A	N/A	N/A
96	Torres-Mora, et al., 2014	57	F	Lumbar (L3)	25	N/A	N/A	N/A	N/A	N/A	N/A	N/A
97	Martin-Reay, et al., 1991	32	M	Sacral (S3-S4)	30X25X15	sudden onset of left buttock and coccygeal pain made worse by sitting	Subtotal	N/A	Pain improvement	N/A	N/A	N/A
98	Yeom, et al., 2022	58	F	Thoracic (T11-T12)	41x16x13	low back pain, paresthesia and cold sensation in both legs for several years. No motor dysfunction in either leg	Gross ressection	No	low back pain and paresthesia in both lower legs were all improved	Yes	No	N/A
99	Yeom, et al., 2022	72	M	Thoracic (T11)	10x6x6	a 6-mo history of low back pain and paresthesia in both legs and a 3-mo history of gait disturbance	Biopsy	No	Symptons maintance	Yes	No	36
100	Azarpira, et al., 2009	37	M	Lumbar (L2)	35	8-month history of lower back pain	Gross ressection	No	N/A	Yes	No	4
101	Mandybur, 1974	59	M	Thoracic (T7)	N/A	17-year history of radicular pain and 9	Subtotal	No	weakness improvement	Yes	Yes	20

						mo weakness in the legs and hesitancy in urination prior apresentation						
102	Leger, et al., 1996	36	M	Cervical (C4)	N/A	sensory disorders in the region of the left C4 spinal root for months	Subtotal	No	N/A	Yes	Yes	N/A
103	Cummings, et al., 1999	51	M	Sacral (S2)	35x30	8-mo history of lower back pain	Biopsy	No	Stable	Yes	Yes	N/A
104	Zonenshayn, et al., 2000	27	F	Lumbar (L2-L3)	11x7	2-month history of left-sided hip, typical of L-2-distribution sciatica. slight weakness in the hip flexors and knee extensors on the left	Gross	No	Pain improvement	Yes	No	6
105	Woodford, et al., 2022	60	M	Cervical (C2-C3), cauda equina	N/A	Numbness/weakness in his hands and neck pain. low back pain and decreased perineal sensation.	Cervical: Gross total ressection. Lumbar: RT	RTX and Imunotherapy	N/A	Yes	Yes	34
106	Woodford, et al., 2022	21	F	Lumbar: L5-S1	45x40	Back pain	Ressection (total ou partial?)	RTX and Imunotherapy	Death	N/A	Yes	N/A
107	Shanmugam, et al., 2015	67	M	Thoracic (T8-T12)	N/A	weakness and numbness in lower limbs	Surgery (ressection, partial or biopsy?)	N/A	N/A	N/A	N/A	N/A
108	Georgiev, et al., 2021	61	M	Lumbar: L3	50x46	low back pain, progressive numbness and stiffness in the right lower limb	Gross total ressection	RTX	Mild hyperesthesia along the L3 dermatom. Peroneal nerve paresis	Yes	Yes	16
109	Jackson, et al., 2021	60	F	Sacral: S1	38	right-sided lower back and leg pain	Gross total ressection	RTX and QTX	Death	36	Yes	36
110	Aprile, et al., 2000	70	F	Lumbar: L3	10	Low back and right leg pain. paraparesis and bilateral hyperalgesia	Gross total ressection	N/A	N/A	Yes	N/A	N/A
111	Aprile, et al., 2000	60	M	Lumbar: L4-L5	N/A	Lumbar pain, Pain in the left leg. hyperalgesia of the leg and hypoaesthesia radiating into the L5-S1 region.	Gross total ressection	N/A	N/A	Yes	N/A	N/A
112	Lowman and Livolsi, 1980	26	F	Cervical: C5-C6	N/A	pain and numbness radiating upwards from the region ofthe right foot. absent vibratory sense and diminution of both pain and touch on the right side	Gross total ressection	No	Improviment. No deficits	Yes	No	204
113	Lowman and Livolsi, 1980	17	F	Thoracic-lumbar: T12-L1	N/A	back pain and left-sided sciatica.	Subtotal	RTX	walks with crutches	Yes	No	168
114	Velz, et al., 2018	32	F	Thoracic: T10-T12	46x42x58	intermittent thoracic and abdominal pain radiating to the right sid	Gross total ressection	RTX	No deficits	Yes	Yes	3

115	French, et al., 2005	76	F	Thoracic-Lumbar: T11-L5	N/A	Lumber back pain. right-sided sensorineural deafness, gait ataxia with falling to right. paraparesis	Biopsy	No	Death	2	No	2
116	Shui, et al., 2022	21	F	Lumbar-sacral: L5-S1	45x40	left L5 radicular pain accompanied by L5 hypoesthesia	Gross total ressection	RTX	the patient was discharged wheelchair-bound	Yes	Yes	7
117	Bonomo, et al., 2023	28	F	Cervical: two lesions C5-C6 and C6-C7	20x10 (larger tumor)	cervical pain radiating to the right arm. mild weakness in the right arm and dysesthesia in the C5-C6 right dermatome	Gross total ressection	No	strength recovery, but dysesthesia slightly improved	Yes	No	12
118	Chakravarthy, 2012	45	F	Lumbar-sacral: L5-S1	21x15x18	Low back pain	Gross total ressection	No	Improviment. No deficits	Yes	No	18

Table S1: Summary of all studies (n=118).

	CARE Checklist
	Description
1. Title	Malignant Melanotic Schwannoma of the Sacrum in a Young Woman: A Case Report and 51-Month Follow-Up
2. Keywords	Melanotic schwannoma, spinal tumor, sacral nerve sheath tumor, malignant peripheral nerve sheath tumor, case report
3. Abstract	Structured abstract provided (Introduction, Case, Outcome, Conclusion)
4. Introduction	Brief overview of melanotic schwannomas, significance of case
5. Patient Information	21-year-old woman, no family history, 2-year history of back pain and radiculopathy
6. Clinical Findings	S1 dermatomal hypoesthesia, radicular pain, no motor deficit
7. Timeline	Table provided with sequence of clinical events
8. Diagnostic Assessment	EMG, MRI, histopathology, immunohistochemistry
9. Therapeutic Intervention	L5-S1 hemilaminectomy, microscopic total resection, adjuvant radiotherapy
10. Follow-up and Outcomes	51 months of follow-up, no recurrence, asymptomatic
11. Discussion	Review of diagnosis, treatment approach, comparison with literature, importance of long-term follow-up
12. Patient Perspective (opt.)	Not included (optional)
13. Informed Consent	Obtained and documented

Table S2: Care checklist (case report).

Study ID	**Demographics described**	**History/timeline clear**	**Clinical condition on presentation**	**Diagnostic tests/results described**	**Intervention clearly described**	**Post-intervention condition described**	**Adverse events described**	**Takeaway lessons present**	**Total Score**	**Risk of Bias**
Acciarri, N; 1999	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Alamer, A 2019	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Aprile, I; 2000	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Arvanitis, LD 2010	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**

Azarpira, N; 2009	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Bakan, S; 2015	Y	Y	Y	Y	Y	Y	N	Y	**7**	**low**
Biju, R; 2020	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Bonomo, G; 2023	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Bosman, C; 1995	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Buhl, R; 2004	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Cerchio, L; 2006	Y	Y	Y	Y	Y	Y	N	Y	**7**	**low**
Chakravarthy, H; 2012	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Chandran, R; 2018	Y	Y	Y	Y	Y	Y	N	Y	**7**	**low**
Chen, D; 2015	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Cheng, X; 2017	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Cummings TJ, ; 1999	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Er, U; 2007	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Erlandson, RA 1985	Y	Y	Y	Y	Y	Y	Y	N	**7**	**low**
Faria, MHG; 2013	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
French, P.J.; 2005	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Georgiev, G.K; 2021	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Gregorios, JB; 1982	Y	Y	Y	Y	Y	Y	N	Y	**7**	**low**
Grosshans, HK; 2020	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Güzel, E; 2016	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Hall, J; 2022	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Hoover, ; 2012	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Hou, Z; 2020	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Hu, L, C Wang 2018	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Jackson, C; 2021	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Khoo, M; 2016	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Leger, F; 1996	Y	Y	Y	Y	Y	Y	N	Y	**7**	**low**
Li, B and Chen, Q 2015	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Li, X; 2019	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Lowman, R.M.; 1980	Y	Y	Y	Y	Y	Y	N	Y	**7**	**low**
Mandybur, TI; 1974	Y	Y	Y	Y	Y	Y	N	Y	**7**	**low**
Marchese, MJ 1990	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**

Martin-Reay, DG; 1991	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Marton, E; 2007	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
McCann, M; 2023	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
McGravan, W; 1979	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Mennemeyer, RP; 1979	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Mohamed, M; 2014	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Mouchaty, H; etl al 2008	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Ng, J and Munoz, DG 2016	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Paris, F; etl at 1979	Y	Y	Y	Y	Y	Y	Y	N	**7**	**low**
Sahay, A; 2020	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Santaguida, C; 2004	Y	Y	Y	Y	Y	Y	N	Y	**7**	**low**
Shabani, S; 2015	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Shanmugam, S; 2015	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Shen, XZ; 2021	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Shields, LBE; 2011	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Shui, C; 2022	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Solomon, RA; 1987	Y	Y	Y	Y	Y	Y	N	Y	**7**	**low**
Solomou, G; 2020	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Soyland, DJ; 2021	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Sun, Z; 2023	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Takatori, N; 2020	Y	Y	Y	Y	Y	Y	N	Y	**7**	**low**
Tawk, R; 2005	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Terry, M; 2022	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Torres-Mora, J; 2014	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Vallat-Decouvelaere AV; 1999	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Velz, J; 2018	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Woodford, R; 2022	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Xiang, Z; 2023	Y	Y	Y	Y	Y	Y	N	Y	**7**	**low**
Yan, X; 2023	Y	Y	Y	Y	Y	Y	N	Y	**7**	**low**

Yeom, JA; 2022	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Yokota, H; 2012	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Zaninovich, O; 2019	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Zhao, Q; 2011	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**
Zonenshayn, M; 2000	Y	Y	Y	Y	Y	Y	Y	Y	**8**	**low**

Table S3: JBI appraisal of the 70 studies.

Section and Topic	Item #	Checklist Item	Reported on Page(s)
Title	1	Identify the report as a systematic review.	Title page, p. 1
Abstract	2	Provide a structured summary including background, objectives, methods, results and conclusions.	Abstract, p. 2-3
Introduction			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Introduction, p. 4-5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	p. 5
Methods			
Eligibility Criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Methods - Systematic review, p. 6-7
Information Sources	6	Specify all databases and other sources searched (e.g., reference lists), with the last search date.	Methods - Systematic review, p. 6-7
Search Strategy	7	Present the full search strategy for each database, including all search terms and filters used.	Methods - Systematic review, p. 6-7
Selection Process	8	Specify the methods used to decide whether a study met inclusion criteria, including number of reviewers and how disagreements were resolved.	Methods - Systematic review, p. 6-7
Data Collection Process	9	Specify how data were collected from reports, including number of reviewers and how disagreements were resolved.	Methods - Systematic review, p. 6-7
Data Items	10	List and define all outcomes for which data were sought and describe any assumptions made.	Methods - Systematic review, p. 6-7
Risk of Bias in Studies	11	Describe any methods used to assess risk of bias in included studies.	Methods - Systematic review, p. 6-7
Effect Measures	12	Specify the effect measures used for each outcome (e.g., risk ratio, mean difference).	Not applicable
Synthesis Methods	13a-13f	Describe synthesis methods, handling of data and how heterogeneity was addressed.	Methods - Systematic review, p. 6-7
Certainty Assessment	15	Describe any methods used to assess certainty in the body of evidence (e.g., GRADE).	Methods - Systematic review, p. 6-7
Results			
Study Selection	16	Provide the number of studies screened, assessed and included, ideally with a flow diagram.	Results - p. 13; Figure - p. 13
Study Characteristics	17	Cite each included study and present its characteristics.	Results, p. 14 Supplementary material
Risk of Bias in Studies	18	Present assessments of risk of bias for each included study.	JBI Appraisal Supplementary material
Results of Individual Studies	19	For all outcomes, present data for each study.	Supplementary material
Results of Syntheses	20	Present summary of findings, heterogeneity and certainty (if applicable).	Results - p.14-15
Discussion			
Discussion of Results	23a	Interpret the results in context, including limitations and implications.	Discussion - p. 11-13

Limitations of Evidence	23b	Discuss limitations of the included evidence.	Discussion - p. 12-13
Limitations of Review Process	23c	Discuss limitations of the review process.	Discussion - p. 13
Other Information			
Registration and Protocol	24	Indicate whether the review protocol was registered.	Not registered
Support	25	Describe sources of financial or non-financial support.	Funding section - p. 19
Competing Interests	26	Declare any competing interests.	Conflicts of Interest - p. 19,20
Availability of Data/Materials	27	Report availability of data, code and other materials.	Supplementary material

Table S4: PRISMA 2020 checklist.

PubMed Search Strategy

("melanotic"[All Fields] OR ("melanocytes"[MeSH Terms] OR "melanocytes"[All Fields] OR "melanocyte"[All Fields] OR "melanocytic"[All Fields])) AND ("neurilemmoma"[MeSH Terms] OR "neurilemmoma"[All Fields] OR "schwannoma"[All Fields] OR "schwannomas"[All Fields]) AND ("spine"[MeSH Terms] OR "spine"[All Fields] OR "spines"[All Fields] OR "spine s"[All Fields])

EMBASE Search Strategy

('melanotic schwannoma'/exp OR 'melanotic schwannoma' OR 'melanocytic schwannoma' OR 'pigmented schwannoma')
AND
('spine'/exp OR 'spinal cord'/exp OR 'vertebra'/exp OR spine OR spinal OR vertebral OR vertebra OR 'spinal canal' OR 'spinal root' OR 'spinal nerve' OR 'spinal tumor' OR 'intraspinal' OR 'intradural').