



ORIGINAL RESEARCH PAPER

CLINICAL PROFILE, SURGICAL MANAGEMENT, AND NEUROLOGICAL OUTCOME OF INTRAMEDULLARY SPINAL CORD TUMOURS: A RETROSPECTIVE CASE SERIES OF 23 PATIENTS FROM A TERTIARY CARE INSTITUTE

Neurosurgery

KEY WORDS: Intramedullary Spinal Cord Tumour; Ependymoma; Extent of Resection; Modified Rankin Scale

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ABSTRACT

Background: Intramedullary spinal cord tumours (IMSTs) are an infrequent but functionally serious category of disease, and published experience from Indian tertiary centres remains limited. **Objective:** To report the clinical, radiological and histopathological profile, operative management, and functional results of patients surgically treated for an IMST at a single tertiary institute, using the modified Rankin Scale (mRS) to quantify outcome. **Methods:** Case records of 23 consecutive patients treated for a confirmed IMST over a 3-year period were reviewed retrospectively for demographics, tumour site, histology, extent of resection, adjuvant therapy, and mRS grade before surgery and at last follow-up. **Results:** Thirteen women and ten men were included (mean age 35.7 years; range 3–77), with three paediatric cases. Motor weakness was universal, while sphincter disturbance (56.5%) and back pain (52.2%) were the other common complaints. Ependymal tumours predominated (16/23, 69.6%), with astrocytoma accounting for a further 13.0%. Near-total or complete excision was possible in 78.3% of cases; three patients with grade III anaplastic ependymoma received adjuvant radiotherapy, and one needed repeat surgery for recurrence. Mean mRS fell from 4.48 pre-operatively to 1.57 at a mean 13.5-month follow-up, with all 23 patients improving and none deteriorating. **Conclusion:** Safety-conscious microsurgical excision, undertaken predominantly for ependymal-lineage tumours, produced consistent and sustained neurological gains on the mRS, even though complete removal was achieved in only a subset of cases. These findings support prompt surgical referral and maximal safe excision as the central strategy in IMST care.

1. INTRODUCTION

Tumours that originate within the substance of the spinal cord are uncommon, making up only 2–4% of central nervous system neoplasms (Samartzis, Gillis, Shih, O'Toole, & Fessler, 2015). Glial tumours, chiefly ependymoma and astrocytoma, constitute the bulk of this group, and while ependymoma is the more frequent adult diagnosis, astrocytoma predominates in children; haemangioblastoma, subependymoma and epidermoid or dermoid cysts make up most of the rest (Kim, Yoo, & Kim, 2020). Because the ascending and descending tracts are so tightly packed within a small cross-section of cord, meaningful neurological deficit can appear well before a tumour becomes radiologically conspicuous, which is why contrast-enhanced MRI is central to diagnosis. Surgical excision, aimed at the greatest resection compatible with neurological safety, remains the backbone of treatment, with radiotherapy reserved for higher-grade or incompletely excised disease (Kutlay et al., 2018). Most published outcome series come from large Western or East Asian centres applying the modified McCormick Scale, whereas comparable data from Indian tertiary institutes — where delayed presentation with more advanced deficits is common — remain scarce. This retrospective series was therefore designed to document presentation, histology, operative management and functional recovery, using the modified Rankin Scale (mRS), among IMST patients treated at our centre.

2. MATERIALS AND METHODS

This retrospective, observational case series was carried out in the Department of Neurosurgery, RNT Medical College, Udaipur, Rajasthan, over a continuous 3-year period. Twenty-three consecutive patients operated for a radiologically suspected and histologically confirmed IMST were included; purely extramedullary cases were excluded. Case notes and operative records were reviewed for age, sex, presenting complaints, mRS grade before surgery, MRI

findings, surgical approach and extent of resection achieved (gross-total, near-total, decompression alone, or biopsy alone), histology with WHO grade, adjuvant treatment, need for re-operation, and mRS at last follow-up. Every patient underwent a posterior midline exposure — laminectomy or laminoplasty — followed by durotomy and midline myelotomy, with the tumour dissected from surrounding cord under microscopic magnification; how much could safely be removed was decided intraoperatively from the clarity of the tumour–cord plane and real-time risk to function. The mRS (0–6) was applied pre-operatively and at final follow-up (Rankin, 1957; van Swieten, Koudstaal, Visser, Schouten, & van Gijn, 1988). Continuous data are presented as mean $\pm$ SD and categorical data as counts with percentages, analysed using Microsoft Excel and SPSS (version 26.0). The study received Institutional Ethics Committee clearance, which waived individual consent given the retrospective design, and all records were de-identified.

3. RESULTS

The final cohort numbered 23 patients (Table 1): a mild female predominance (56.5%), a broad age range of 3–77 years (mean 35.7 ± 19.9), and three children. Motor weakness was universal, while sphincter involvement (56.5%) and back pain (52.2%) were the next most common complaints. The cervicothoracic cord was the commonest site (30.4%), followed by the thoracolumbar cord/conus medullaris (17.4%), and many lesions spanned several vertebral levels; one patient's cervicomedullary haemangioblastoma occurred in the setting of Von Hippel–Lindau syndrome.

Table 1. Demographic and Clinical Profile of the Study Cohort (n = 23)

Parameter	Value
Total patients, n	23
Age, years (mean $\pm$ SD; range)	35.7 ± 19.9 ; 3–77

Paediatric patients (<18 y), n (%)	3 (13.0)
Female / Male, n (%)	13 (56.5) / 10 (43.5)
Motor weakness, n (%)	23 (100.0)
Bowel/bladder involvement, n (%)	13 (56.5)
Back pain, n (%)	12 (52.2)
Sensory deficit, n (%)	6 (26.1)
Neuropathic pain, n (%)	4 (17.4)

Ependymal-lineage tumours dominated the histological breakdown, making up 16 of 23 cases (69.6%); astrocytoma followed at 13.0%, with the remainder distributed among haemangioblastoma, epidermoid cyst, lipoma and a single inflammatory mass. Among graded lesions, WHO grade II was commonest (8/23), ahead of grade III (6/23) and grade I (5/23) (Table 2).

Table 2. Histopathological Spectrum and WHO Grade Distribution (n = 23)

Histopathology / WHO Grade	n (%)
Ependymal-lineage tumours (total)	16 (69.6)
Astrocytoma	3 (13.0)
Other (haemangioblastoma, epidermoid cyst, lipoma, non-neoplastic)	4 (17.4)
WHO grade I	5 (21.7)
WHO grade II	8 (34.8)
WHO grade III	6 (26.1)
Not graded (benign/non-neoplastic)	4 (17.4)

Near-total or gross-total excision was achieved in 18 of 23 patients (78.3%); the rest underwent decompression alone (three patients, 13.0%) or biopsy alone (two patients, 8.7%), usually because the tumour–cord margin was poorly defined. Adjuvant radiotherapy followed in the three patients with WHO grade III anaplastic ependymoma, and the single recurrence — the Von Hippel–Lindau-associated haemangioblastoma — was re-excised. The mean mRS fell from 4.48 (median 5) pre-operatively to 1.57 (median 1) at a mean 13.5-month follow-up (range 10 days–30 months); all 23 patients improved and none worsened (Table 3, Figure 1).

Table 3. Surgical Management, Adjuvant Treatment and Functional Outcome (n = 23)

Surgical / Functional Outcome	Value
Near-total excision, n (%)	15 (65.2)
Gross-total excision, n (%)	3 (13.0)
Decompression only, n (%)	3 (13.0)
Biopsy only, n (%)	2 (8.7)
Pre-operative mRS, mean (median)	4.48 (5)
Last follow-up mRS, mean (median)	1.57 (1)
Mean follow-up, months (range)	13.5 (0.3–30)
Improved from baseline, n (%)	23 (100.0)
Adjuvant radiotherapy, n (%)	3 (13.0)
Re-surgery for recurrence, n (%)	1 (4.3)

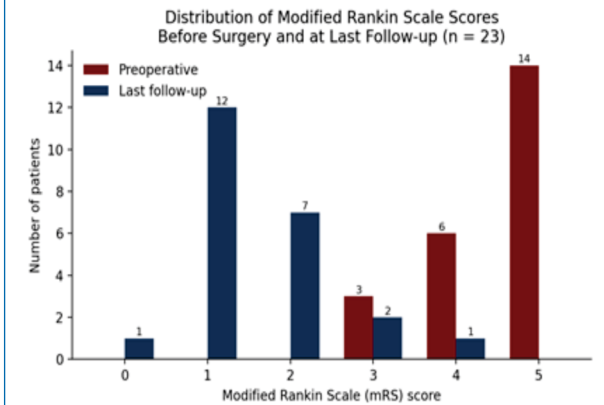


Figure 1. Distribution of Modified Rankin Scale (mRS) Scores Before Surgery and at Last Follow-Up (n = 23), Showing a Leftward Shift with Improvement in all Patients.

4.DISCUSSION

That ependymal tumours dominated our cohort, with astrocytoma a distant second, fits well with prior reports that gliomas make up most IMSCTs and that ependymoma is the typical adult diagnosis (Kim et al., 2020; Karabacak, Margetis, & Morgenstern, 2024). Our resection rates — near-total or complete in 78.3% — sit toward the conservative end of what has been published from large single-centre ependymoma cohorts, where gross-total resection alone has ranged from 65% to 93% (Bostrom et al., 2025; Zhang et al., 2022). This likely reflects a surgical philosophy that favoured leaving a thin margin of tumour behind rather than chasing complete clearance once the tumour–cord interface became indistinct, consistent with the principle that safe resection, not resection at any cost, drives functional recovery (Kutlay et al., 2018).

Perhaps the most striking finding is how uniformly patients improved — all 23 gained ground on the mRS and none was left unchanged or worse, a better profile than the 65–85% improved-or-stable figures usually quoted (Bostrom et al., 2025; Alattar et al., 2024). A few explanations seem plausible: many patients presented with severe disability from acute cord compression that can resolve quickly once decompressed, somewhat independent of resection extent; our follow-up was comparatively brief and uneven (mean 13.5 months), which may not have captured later recurrence-related decline, particularly for the anaplastic ependymomas; and, as with any single-institution series, selection bias cannot be excluded. The one exception — the Von Hippel–Lindau-associated haemangioblastoma needing repeat surgery — is a reminder that syndromic tumours carry an ongoing recurrence risk even when initial results are good. Using the mRS rather than the disease-specific modified McCormick Scale eases comparison with the general neurosurgical literature, though it may be less sensitive to subtle gait or sphincter deficits.

A retrospective, single-institution design with a modest patient count means we could not attempt multivariable analysis of the factors likely to influence prognosis, and the short and inconsistent follow-up period restricts what can be said about long-term recurrence or whether the functional gains we observed will be durable.

5.CONCLUSION

Across these 23 patients, most of whom had ependymal-lineage tumours, a strategy of maximal yet safety-conscious microsurgical excision yielded near-total or gross-total removal in the majority of cases. Functional status by mRS improved consistently across the cohort, which lends support to early referral for surgery and to maximal safe resection as the central tenet of IMSCT care, reserving radiotherapy for high-grade disease. Confirming the durability of these results, and identifying which factors best predict long-term neurological and oncological outcome, will require larger, prospective, multi-centre studies with longer follow-up.

REFERENCES

- Alattar, A. A., et al. (2024). Survival and functional outcomes following surgical resection of intramedullary spinal cord tumors: A series of 253 patients over 22 years. *World Neurosurgery*.
- Bostrom, A., von Lehe, M., Hartmann, W., et al. (2025). Radiological, histopathological, and surgical outcomes of intradural spinal ependymomas: A single-center retrospective series. *Journal of Neuro-Oncology*.
- Karabacak, M., Margetis, K., & Morgenstern, P. (2024). Pediatric intramedullary spinal cord tumors: A National Cancer Database analysis of demographics, patterns of care, and survival. *Journal of Neuro-Oncology*.
- Kim, H., Yoo, H., Kim, J. H., et al. (2020). Practice essentials: Intramedullary spinal cord tumors—epidemiology, etiology and pathophysiology. *Medscape Reference*.
- Kutlay, M., et al. (2018). Outcome of surgery for intramedullary spinal ependymoma. *World Neurosurgery*.
- Lee, J., et al. (2022). Pathological classification of the intramedullary spinal cord tumors according to 2021 WHO classification of central nervous system tumors, a single-institute experience. *Neurospine*, 19(3).
- Louis, D. N., Perry, A., Wesseling, P., et al. (2021). The 2021 WHO classification of tumors of the central nervous system: A summary. *Neuro-Oncology*, 23(8), 1231–1251.
- Rankin, J. (1957). Cerebral vascular accidents in patients over the age of 60: II. Prognosis. *Scottish Medical Journal*, 2(5), 200–215.

9. Samartzis, D., Gillis, C. C., Shih, P., O'Toole, J. E., & Fessler, R. G. (2015). Intramedullary spinal cord tumors: Part I—epidemiology, pathophysiology, and diagnosis. *Global Spine Journal*, 5(5), 425–435.
10. van Swieten, J. C., Koudstaal, P. J., Visser, M. C., Schouten, H. J., & van Gijn, J. (1988). Interobserver agreement for the assessment of handicap in stroke patients. *Stroke*, 19(5), 604–607.
11. Xu, W., Zhu, Y., Wang, X., et al. (2024). Incidence and survival of patients with malignant primary spinal cord tumors: A population-based analysis. *Neurospine*, 21(2).
12. Zhang, M., et al. (2022). Magnetic resonance imaging indicators for neurological outcome after surgery in patients with intramedullary spinal ependymomas. *Medicine (Baltimore)*, 101.