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Beyond the Cure: A Case Report on the Role of Physical Medicine and Rehabilitation in Palliative Care for Aggressive Central Nervous System Tumors

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Diana Serra [1], Ana Teixeira-Vaz [1]

1. Physical Medicine and Rehabilitation Department, Centro Hospitalar Universitário de São João, Porto, PRT

Corresponding author: Diana Serra, diana.serra@hotmail.com

Abstract

We report the case of a 23-year-old woman diagnosed with a multifocal spinal ependymoma with MYCN amplification and high-grade histology (Central Nervous System (CNS) World Health Organization (WHO) grade 3) involving the cervicomedullary junction and T10-T12 levels. Following partial surgical resection and craniospinal radiotherapy, the patient presented with complete paraplegia (American Spinal Injury Association Impairment Scale (AIS) grade A), lower-limb spasticity, and neurogenic bladder and bowel dysfunction. A multimodal physical medicine and rehabilitation (PM&R) program was implemented, including pharmacological management of spasticity, physiotherapy, and prescription of assistive devices. At six months, improvements in functional status and self-rated health were documented, with the Spinal Cord Independence Measure, version III (SCIM III), increasing from 18/100 to 32/100, the Functional Independence Measure (FIM) increasing from 54 to 66, and the EQ visual analog scale (EQ VAS) increasing from 30/100 to 50/100, without documented secondary complications. This case illustrates the potential contribution of PM&R within multidisciplinary care to functional independence and patient-reported health status in individuals with aggressive central nervous system tumors, even in the context of a poor prognosis.

Categories: Palliative Care, Physical Medicine & Rehabilitation
Keywords: central nervous system neoplasms, ependymoma, neurological rehabilitation, palliative care, physical medicine & rehabilitation, quality of life

Introduction

Ependymomas are rare neoplasms of the central nervous system (CNS), originating from ependymal cells that line the ventricles of the brain and the central canal of the spinal cord. They account for approximately 1.7% of all primary brain and other CNS tumors and occur across all age groups [1-2]. While spinal ependymomas are more common in adults, intracranial tumors predominate in children, particularly in the posterior fossa [2].

According to the 2021 World Health Organization (WHO) Classification of Tumors of the Central Nervous System, ependymomas are diagnosed through an integrated approach combining anatomic location, histology, and molecular features and are assigned CNS WHO grades 1-3 [3-4]. This classification recognizes ten types of ependymoma, including supratentorial tumors with ZFTA or YAP1 fusions, posterior fossa groups A and B, and spinal ependymomas with MYCN amplification, the latter being grade 3 tumors with aggressive behavior and a propensity for neuraxis dissemination [3-4].

The standard treatment for ependymomas includes maximal safe surgical resection followed by adjuvant radiotherapy, as the extent of resection is a key prognostic factor [2]. The role of chemotherapy remains uncertain, particularly in MYCN-amplified spinal ependymomas, for which evidence is limited to small clinical series, and no established chemotherapy regimen has demonstrated consistent efficacy [2,5]. Despite advances in treatment, the prognosis for high-grade ependymomas, especially those with molecular markers of aggressiveness, such as MYCN amplification, remains poor, with high rates of recurrence and progression. Spinal ependymomas with MYCN amplification (SP-EPN-MYCN) carry a particularly unfavorable prognosis, with a median progression-free survival of 17 months and a median overall survival of 87 months [5]. A large cohort study of 2,023 ependymomas demonstrated that patients with EPN-MYCN had a 10-year overall survival rate of only 32% [6].

In this context, physical medicine and rehabilitation (PM&R) plays an important role in managing the debilitating sequelae of the disease and its treatment [7-8]. Patients may present with severe neurological deficits, including paraplegia, neurogenic bladder and bowel dysfunction, and spasticity, which significantly affect their quality of life. Early rehabilitation may help address these functional limitations through interventions such as pharmacological management of spasticity, structured bowel and bladder regimens, and prescription of assistive devices. However, evidence specifically addressing rehabilitation outcomes in patients with MYCN-amplified spinal ependymomas remains limited. This case illustrates the potential

contribution of PM&R within a multidisciplinary approach to improving functional independence and patient-reported health status, even in the context of a poor prognosis. This case report was prepared in accordance with the CARE guidelines for case reports [9].

Case Presentation

A previously healthy and functionally independent 23-year-old woman presented to the emergency department with progressive paraparesis evolving over two months. Subsequent diagnostic evaluation revealed a multifocal MYCN-amplified spinal ependymoma with high-grade histology (CNS WHO grade 3), involving the cervicomedullary junction and T10-T12 levels (Figures *1A*-*1B*). Partial surgical resection of the T10-T12 lesion was performed (Figure *1C*), followed by craniospinal radiotherapy, which was completed approximately two months later.

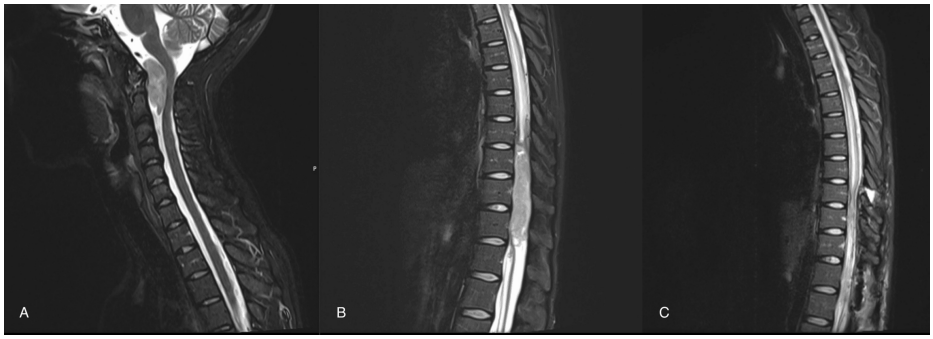


FIGURE 1: Multifocal grade 3 spinal ependymoma.

Sagittal T2-weighted short tau inversion recovery (STIR) magnetic resonance images of the spinal cord. (A) Preoperative lesion at the cervicomedullary junction. (B) Preoperative lesion at the T10-T12 level. (C) Postoperative appearance following partial resection of the T10-T12 lesion.

At the first physical medicine and rehabilitation (PM&R) evaluation, six days after surgery, the patient had complete paraplegia (American Spinal Injury Association Impairment Scale (AIS) grade A) [10], a neurological level of injury at T9, lower-limb spasticity (Modified Ashworth Scale (MAS) grade 2 in the hamstrings, adductors, and triceps surae muscles) [11], spasms (Penn Spasm Frequency Scale grade 3) [12], and neurogenic bladder and bowel dysfunction. The Spinal Cord Independence Measure, version III (SCIM III), total score was 18/100 (self-care 8/20; respiration/sphincter management 10/40; mobility 0/40) [13], and the Functional Independence Measure (FIM) score was 54 [14], reflecting moderate dependence in basic activities of daily living (ADLs). The EQ visual analog scale (EQ VAS) score was 30/100, reflecting the patient's self-rated health status [15].

The patient underwent a multimodal PM&R program, including pharmacological optimization with baclofen 20 mg three times daily and tizanidine 4 mg once daily to manage spasticity and spasms, improve positioning, and reduce pain, as well as laxative agents (a structured regimen combining oral and suppository bisacodyl) to promote predictable evacuation. During hospitalization, the patient also received pharmacological prophylaxis against venous thromboembolism with enoxaparin. Twice-weekly physiotherapy sessions, lasting approximately 45 minutes each, focused on preserving joint mobility, improving upper-limb strength, reducing spasticity, and optimizing functional capacity for basic ADLs, including transfers. Assistive devices were prescribed to enhance mobility, reduce pressure ulcer risk, and promote autonomy in ADLs, namely nighttime splints (ankle-foot orthoses), a lightweight wheelchair with a pressure-relief cushion, a toilet chair, and a transfer board. Education on regular repositioning, pressure relief, and skin inspection was also provided to prevent pressure injuries. Bladder dysfunction was managed with an indwelling urethral catheter because the patient declined intermittent catheterization and suprapubic catheter placement.

At the six-month outpatient reevaluation, the SCIM III total score increased from 18/100 to 32/100 (self-care increased from 8 to 11/20; respiration/sphincter management increased from 10 to 15/40; mobility increased from 0 to 6/40), reflecting improvements across all three functional domains. A slight reduction in hip adductor spasticity was observed (MAS grade 2 to 1+), accompanied by a decrease in spasm frequency (Penn Spasm Frequency Scale grade 3 to 1). The FIM score increased from 54 to 66, indicating greater functional independence, while the EQ VAS score improved from 30/100 to 50/100, reflecting better self-rated health status. The structured bowel management program was maintained, allowing predictable bowel movements without episodes of fecal incontinence between evacuations. Follow-up spinal magnetic resonance imaging demonstrated stable disease, with no evidence of radiological progression of the previously identified lesions (Figure *2*). No respiratory, cardiovascular, skin, urinary, or thromboembolic complications were documented during the six-month follow-up. The main clinical milestones and functional outcomes are summarized in Tables *1*-*2*, respectively.

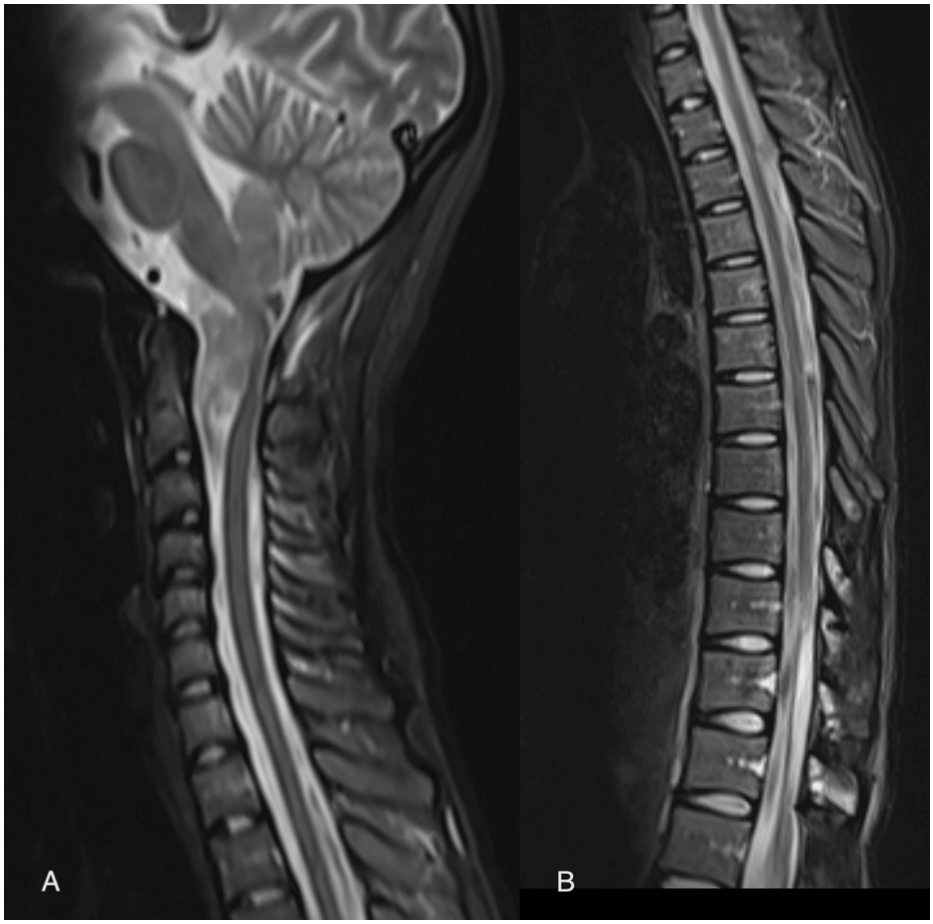


FIGURE 2: Six-month follow-up spinal magnetic resonance imaging.

Sagittal T2-weighted short tau inversion recovery (STIR) images demonstrating stable radiological findings without evidence of disease progression. (A) Cervicomedullary junction. (B) T10-T12 level.

Time point	Clinical event
Two months before diagnosis	Onset and progressive worsening of paraparesis
At diagnosis	Emergency department presentation, diagnosis of multifocal MYCN-amplified spinal ependymoma, and hospital admission for surgical treatment
Surgery (day 0)	Partial resection of the T10-T12 lesion
Postoperative day 6	Initial PM&R assessment, documenting complete paraplegia (AIS A) and significant functional dependence
Approximately two months after surgery	Completion of craniospinal radiotherapy
Six months after surgery	PM&R reassessment demonstrating functional improvement; follow-up MRI showing radiological stability

TABLE 1: Clinical timeline from symptom onset to the six-month postoperative follow-up.

PM&R, physical medicine and rehabilitation; AIS, American Spinal Injury Association Impairment Scale; MRI, magnetic resonance imaging

Outcome measure	Baseline	6 months
SCIM III - Total	18/100	32/100
SCIM III - Self-care	8/20	11/20
SCIM III - Respiration and sphincter management	10/40	15/40
SCIM III - Mobility	0/40	6/40
FIM - Total	54	66
EQ VAS	30/100	50/100
Penn Spasm Frequency Scale	3	1
MAS - Hip adductors	2	1+

TABLE 2: Clinical and functional outcomes at baseline and six-month follow-up.

Baseline corresponds to the initial PM&R assessment six days after surgery.

SCIM III, Spinal Cord Independence Measure, version III; FIM, Functional Independence Measure; EQ VAS, EuroQol visual analog scale; MAS, Modified Ashworth Scale

Discussion

This case underscores the complexity of managing aggressive CNS tumors, such as high-grade spinal ependymomas, which are frequently associated with severe neurological impairment and a substantial decline in functional independence. Beyond the oncological burden, these tumors profoundly affect mobility, autonomy, and overall quality of life, particularly in advanced stages when curative treatment is no longer feasible.

In this context, PM&R assumes a central role within a multidisciplinary care framework [7-8,16]. The management of spinal cord tumors with associated neurological deficits requires coordination between oncological, surgical, and rehabilitation teams to address both disease-related and functional needs. Rather than focusing solely on disease modification, PM&R prioritizes the optimization of functional capacity, symptom relief, and the prevention of secondary complications associated with immobility and neurological deficits. Targeted interventions, including individualized physiotherapy programs, appropriate pharmacological management, and the prescription of assistive devices, are essential for maintaining mobility, reducing pain, and enhancing daily functioning. In the present case, an indwelling urethral catheter was maintained according to the patient's preference, without documented urinary complications during the six-month follow-up. Nevertheless, long-term catheterization carries risks of urinary tract infections, bladder stones, and urethral complications, highlighting the importance of continued urological surveillance.

Evidence from patients with spinal cord injury due to tumors demonstrates that specialized rehabilitation can yield meaningful functional gains. Tan and New reported median FIM motor gains of 17 points in patients with primary spinal tumors and 7 points in those with metastatic tumors, supporting the potential for functional improvement following specialized rehabilitation [17]. In the present case, the patient's total FIM score increased from 54 to 66 over six months, illustrating functional improvement despite complete paraplegia and aggressive tumor pathology. Nevertheless, the six-month follow-up does not allow assessment of potential long-term complications or subsequent functional decline, highlighting the importance of continued rehabilitation follow-up.

Despite these gains, access to cancer rehabilitation remains limited. Studies indicate that oncology patients with functional limitations frequently underutilize rehabilitation services, representing a significant gap in comprehensive cancer care [18]. Barriers include a lack of awareness among oncologists, limited availability of specialized cancer rehabilitation programs, and misconceptions that rehabilitation is appropriate only for patients with favorable prognoses [18]. This case illustrates that even patients with limited life expectancy can benefit substantially from rehabilitation interventions focused on maximizing independence and quality of life.

Importantly, PM&R contributes not only to physical improvement but also to the preservation of patient autonomy and dignity. Cheville et al. (2017) describe palliative rehabilitation as function-directed care delivered in collaboration with other clinical disciplines, aligned with patients' values, and aimed at achieving meaningful goals despite serious or incurable illness [16]. By addressing functional limitations and

promoting active participation in daily activities, rehabilitation strategies help mitigate the psychosocial impact of disease progression. This approach is particularly relevant in palliative care settings, where the primary goal shifts toward maximizing comfort and quality of life [16].

The National Comprehensive Cancer Network (NCCN) Guidelines for Central Nervous System Cancers explicitly recommend that patients with spine tumors receive multidisciplinary care, including physical and rehabilitation medicine, physiatry, and physical therapy, to address complex physical, psychological, and social care needs [19]. Similarly, the American College of Surgeons' Optimal Resources for Cancer Care standards emphasize that rehabilitation care services should be continuously available throughout treatment, surveillance, and end-of-life care [20]. These guidelines support the integration demonstrated in this case, in which PM&R interventions were initiated early after surgery and continued throughout the patient's oncological treatment trajectory.

Conclusions

This case illustrates the potential contribution of early, function-directed PM&R to improving functional independence and patient-reported health status in individuals with aggressive CNS tumors. Integrating rehabilitation into multidisciplinary care may help address functional limitations and support patient-centered goals, even in the context of a poor prognosis. Further research is needed to evaluate the effectiveness of rehabilitation interventions and identify optimal strategies for integrating PM&R into neuro-oncology care pathways.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Diana Serra

Acquisition, analysis, or interpretation of data: Diana Serra, Ana Teixeira-Vaz

Drafting of the manuscript: Diana Serra

Critical review of the manuscript for important intellectual content: Ana Teixeira-Vaz

Supervision: Ana Teixeira-Vaz

Disclosures

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