Scholars Journal of Medical Case Reports
Abbreviated Key Title: Sch J Med Case Rep
ISSN 2347-9507 (Print) | ISSN 2347-6559 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Radiation Oncology

Spinal Metastasis of Glioblastoma: A Case Report

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DOI: https://doi.org/10.36347/sjmcr.2025.v13i05.126 | **Received:** 16.04.2025 | **Accepted:** 20.05.2025 | **Published:** 29.05.2025

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Abstract **Case Report**

Spinal metastases originating from glioblastoma (GBM) are exceedingly rare and present significant clinical challenges. The physiopathology behind this phenomenon involves tumor spread via cerebrospinal fluid pathways, particularly in cases where the primary brain tumor is located near the ventricular or subarachnoid spaces. Diagnosing spinal metastases from GBM requires multimodal imaging, which is essential for both confirming the diagnosis and guiding treatment. Treatment options remain limited, with a focus on palliative care, as survival rates for patients with spinal involvement are poor. This case report discusses a 61-year-old woman with a history of glioblastoma who developed secondary spinal metastases, outlining the clinical presentation, diagnostic workup, and management challenges associated with these rare and aggressive metastases.

Keywords: Glioblastoma (GBM), Spinal metastases, Cerebrospinal fluid (CSF), Drop metastasis, Palliative care.

INTRODUCTION

Glioblastoma (GBM) is the most aggressive primary brain tumor, characterized by rapid growth and a high propensity for recurrence. Despite significant advances in surgical resection, radiotherapy, and chemotherapy, the prognosis remains poor, with median survival rates of approximately 14-18 months post-diagnosis [1]. Distant metastasis from glioblastoma is a rare phenomenon, with spinal cord involvement being even more uncommon. Spinal metastases from GBM often occur late in the disease course and are associated with a significant decline in functional status and quality of life. These metastases represent an advanced stage of tumor dissemination and are notoriously difficult to treat, with few therapeutic options available.

The mechanisms behind spinal dissemination of GBM are not fully understood, but several theories exist. One proposed mechanism is the spread of tumor cells via cerebrospinal fluid (CSF), leading to leptomeningeal and intramedullary spinal involvement, often termed "drop metastasis" [2]. Grabb *et al*., [3], proposed that recraniotomy carries a higher risk of CSF dispersion, most likely due to repeated manipulation, a more aggressive tumor form, and immune function depression brought on by chemotherapy and radiation therapy. In addition, multiple reports of peritoneal and postoperative metastases after ventriculoperitoneal shunt implantation have shown that intraoperative manipulation and displacement of malignant cells into the blood, CSF, and lymphatic system can cause metastatic disease [4-6]. The proximity of the cerebral lesion to the ventricular system and intraoperative ventricular entrance, however, continue to be debatable variables in the elevated risk of CSF spread [7, 8].

Furthermore, extracranial metastases without craniotomy have been documented.Spinal metastasis from GBM can lead to serious neurological impairments, including back pain, motor weakness, sensory loss, and even paralysis, contributing to the clinical complexity of managing these cases. This case report presents a 61-year-old woman with spinal metastasis from GBM, discussing diagnostic strategies, treatment options, and prognostic factors.

CASE REPORT

A 61-year-old woman with a history of glioblastoma multiforme diagnosed two years prior presented with a new onset of severe back pain, progressive bilateral lower limb weakness, and difficulty walking. Her initial diagnosis was made following an episode of aphasia, alexia, and episodic headaches. MRI of the brain revealed a left temporal intra-axial tumor

surrounded by significant perilesional edema, with an additional right-sided extra-axial lesion suspected to be a meningioma. Gross total resection of the brain lesion was performed, and histopathological analysis confirmed the diagnosis of IDH-wild type glioblastoma.

The patient was then treated with adjuvant radiotherapy and chemotherapy with temozolomide, resulting in an initial favorable clinical and radiological response. Over the course of 20 months, however, the patient experienced progressive symptoms including back pain, sensory changes, and worsening gait. Further investigation through spinal MRI revealed a large intramedullary lesion from the D3 to D5 vertebrae, measuring 7.2 × 6.8 × 5.5 cm. This lesion caused significant spinal cord compression, and associated epidural involvement was also noted. A PET-CT scan with ^18F-FDG identified hypermetabolic activity in the spinal cord, particularly at the thoracic 4 and 5 levels, confirming the diagnosis of secondary spinal metastasis from GBM.

Given the rapid progression and neurological deficits, the patient underwent external beam radiotherapy targeting the spinal lesion, receiving a total dose of 30 Gy in 10 fractions. Temozolomide chemotherapy was continued. Despite these interventions, the patient's neurological status continued to decline, with increasing paraparesis and a deteriorating functional status. Given the poor prognosis and limited treatment options, the patient transitioned to palliative care, focusing on comfort and quality of life.

DISCUSSION

Spinal metastases from glioblastoma multiforme are exceptionally rare, with reported incidences ranging from 1% to 2% of all glioblastoma cases [9]. The pathophysiology underlying spinal metastasis involves the hematogenous spread of tumor cells, direct extension through the cerebrospinal fluid, or retrograde venous flow from the brain [10]. The "drop metastasis" theory is particularly relevant in glioblastoma, where tumor cells spread via CSF pathways from the primary tumor site to the spinal cord, typically causing leptomeningeal spread and sometimes intramedullary involvement [11].

Early diagnosis of spinal metastases from glioblastoma is challenging due to the nonspecific nature of symptoms, which may include back pain, weakness, sensory changes, and radiculopathy. Imaging plays a crucial role in the detection of spinal cord involvement. MRI with gadolinium contrast is the modality of choice for detecting leptomeningeal spread and intramedullary lesions [12]. T1-weighted sequences with contrast are particularly sensitive in visualizing tumor extension into the CSF spaces. In cases where MRI findings are inconclusive or when more precise metabolic data is needed, PET-CT scanning, particularly using amino acid tracers such as ^18F-FET or ^18F-DOPA, can provide critical information to differentiate between tumor recurrence and post-treatment changes, guiding biopsy and treatment planning [13, 14].

Treatment of spinal metastases from glioblastoma remains primarily palliative. Surgical resection is generally not feasible due to the infiltrative nature of the tumor and the delicate anatomy of the spinal cord [9]. Radiotherapy is the mainstay of treatment, with external beam radiotherapy offering symptomatic relief and local control of the lesion. In certain cases, stereotactic body radiotherapy (SBRT) may be considered for more localized lesions or where precision targeting is necessary [15]. A study by Aoyama *et al*., demonstrated that SBRT provided significant improvements in pain control and neurological function in patients with spinal metastases from various cancers, though data specifically for GBM are limited [16].

Chemotherapy for spinal metastases from GBM is less effective due to the blood-spinal cord barrier, which limits the delivery of systemic agents to the spinal cord. However, temozolomide, the standard chemotherapeutic agent for GBM, may still be used, though its efficacy in spinal metastases is debatable [17]. Bevacizumab, an anti-VEGF agent, has been explored in the context of GBM for its ability to reduce edema and vascularity, and some studies have reported stabilization of disease in patients with spinal metastases when combined with radiation therapy [18]. However, resistance to treatment is common, and the survival benefit is generally modest.

Prognosis for patients with spinal metastases from GBM is extremely poor, with median survival after spinal involvement often less than six months [19]. This highlights the importance of early detection and comprehensive management, which includes not only surgical and radiotherapeutic interventions but also a palliative care approach to improve quality of life.

CONCLUSION

Spinal metastases from glioblastoma multiforme are a rare and devastating manifestation of the disease. The management of these metastases is primarily palliative, and while radiotherapy remains the cornerstone of treatment, the prognosis remains poor. Advances in imaging technologies and the use of targeted therapies hold promise for improving early diagnosis and treatment outcomes. Future research into new therapeutic strategies, including immunotherapy and molecularly targeted therapies, may offer hope for patients suffering from this aggressive disease.

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