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Case Report

RARE CASE OF SOLITARY BRAIN METASTASIS FROM COLORECTAL CANCER

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ABSTRACT

Introduction: Solitary brain metastases (BM) from colorectal cancer (CRC) are extremely rare, with an incidence of 0.6–3.2%, which pose significant challenges in management. When the metastasis is located in an eloquent brain region, surgical resection may not be feasible, making stereotactic radiotherapy (SRT) a preferred treatment option. A good performance further influences the choice of aggressive treatment strategies.
Case Illustration: A 49-year-old male with a KPS of 90 presented with worsening right-sided pulsating headaches for five days, accompanied by left-sided facial nerve palsy. MRI revealed a solitary intra-axial metastasis in the right temporal lobe, an eloquent region, with microbleeds and surrounding edema, suggestive of BM from rectal adenocarcinoma. Given the lesion's eloquent location, where surgery posed high risks, SRT was selected as the primary treatment modality, alongside corticosteroids for edema control and psychiatric support for depression.
Discussion: Solitary BM from CRC in an eloquent brain region is rare and poses a complex treatment dilemma. While surgery is standard for resectable lesions, tumors in eloquent areas require alternative approaches like SRT, which offers precise tumor control while minimizing neurological deficits. Patients with a high KPS (≥90) and limited metastases benefit most from SRT, as it preserves cognitive function and improves survival outcomes. A multidisciplinary and holistic treatment approach, addressing both oncological and psychological aspects, is essential.
Conclusion: Solitary BM from CRC in an eloquent brain region presents a unique challenge. SRT was chosen over surgery due to the lesion's critical location, reducing the risk of neurological impairment while maintaining tumor control. Patients with good performance scores can achieve better outcomes with SRT when surgical resection is not an ideal option. A multidisciplinary approach is crucial to optimizing care and improving quality of life.

Keywords: solitary brain metastasis, colorectal cancer, stereotactic radiotherapy, eloquent brain region, Karnofsky Performance Score

INTRODUCTION

Brain metastases (BM) represent the most common intracranial tumors in adults, occurring in 10–30% of all cancer patients.[1] They are most frequently associated with lung cancer, breast cancer, melanoma, and renal cell carcinoma, while colorectal

cancer (CRC) rarely metastasizes to the brain.[2] The incidence of BM from CRC is low, estimated at 0.6–3.2%, making it an uncommon yet significant complication.[3] When BM occurs in CRC patients, it is often associated with advanced-stage disease and is usually found after the detection of extracranial metastases, particularly in the liver and lungs.[4]

The clinical presentation of BM varies, depending on the location, size, and number of metastatic lesions. Common symptoms include headache, seizures, cognitive dysfunction, and focal neurological deficits, which are often a result of direct tumor invasion, peritumoral edema, or increased intracranial pressure.[5] Neurological deficits strongly correlate with tumor location, as different brain regions control distinct motor, sensory, and cognitive functions.[6] For instance, lesions near the motor cortex or corticospinal tract may cause hemiparesis, while those in the temporal lobe may lead to memory impairment or language dysfunction.[7]

Imaging plays a crucial role in the diagnosis and management of BM, with MRI being the preferred modality due to its high sensitivity in detecting metastatic lesions and associated edema.[8] Solitary BM from CRC is rare, as most cases present with multiple lesions, influencing both prognostic outcomes and therapeutic approaches.[9] Management strategies depend on the number of metastases, tumor burden, patient performance status, and neurological symptoms.[10] In patients with a single, symptomatic lesion, treatment options include surgical resection, stereotactic radiosurgery (SRS), or stereotactic radiotherapy (SRT).[11] Surgery is often recommended for large, surgically accessible lesions causing significant mass effect, whereas SRT is preferred for lesions in eloquent brain regions where surgery poses a high risk of permanent neurological deficits.[12]

In addition to tumor-directed therapy, corticosteroids such as dexamethasone are commonly used to manage peritumoral edema and reduce intracranial pressure, significantly improving symptoms

like headache and motor dysfunction.[13] Furthermore, psychosocial and neuropsychiatric support is essential, as depression and cognitive impairment frequently affect BM patients, impacting quality of life and treatment adherence.[14] A multidisciplinary approach involving neurology, oncology, radiation therapy, neurosurgery, and palliative care is critical in optimizing outcomes for these patients.[15]

This report presents a case of solitary BM from CRC involving the right temporal lobe near the motor cortex, highlighting the challenges of managing brain metastases in eloquent brain regions and the role of multimodal therapy in improving patient outcomes.

CASE ILLUSTRATION

A 49-year-old male presented with a five-day history of worsening right-sided pulsatile headaches, which had been persistent for three weeks prior to admission. The headaches were severe enough to disturb his sleep, but there was no associated nausea or vomiting. On neurological examination, the patient exhibited left-sided central facial nerve paresis (cranial nerve VII) and left-sided hemiparesis, consistent with a right temporal lobe lesion affecting motor pathways and cranial nerve control.

The patient had a history of stage IV rectal adenocarcinoma, diagnosed in early 2024 after experiencing rectal bleeding. He had undergone eight cycles of chemotherapy (capecitabine and oxaliplatin) and five sessions of pelvic radiotherapy in Penang, Malaysia. Due to tumor progression and financial constraints, he transitioned to treatment at a tertiary hospital in Indonesia, where he was planned to receive FOLFIRI chemotherapy.

Brain MRI with contrast revealed a solitary intra-axial lesion in the right temporal lobe, measuring 2.9 × 2.8 × 2.2 cm, with microbleeds and extensive perilesional edema. The lesion exhibited heterogeneous post-contrast enhancement without diffusion restriction, features highly suggestive of brain metastasis (BM) from colorectal adenocarcinoma. There was a

significant mass effect with midline shift of 1.2 cm, compression of the right lateral ventricle, and displacement of the basal ganglia, mesencephalon, and pons toward the left side. These findings are illustrated in Figure 1, a collaged image showing axial, sagittal, and coronal MRI sections of the lesion.

Given the lesion's location in the right temporal lobe, an eloquent region crucial for memory, language processing, and motor function, surgical resection was deemed high-risk due to the potential for severe neurological impairment. Stereotactic radiotherapy (SRT) was chosen as the primary treatment modality, offering precise tumor control while minimizing functional deficits. To reduce vasogenic edema and intracranial pressure, the patient was started on dexamethasone 10 mg IV twice daily, with gradual tapering as per clinical response.

During hospitalization, the patient showed partial neurological improvement following dexamethasone therapy. His headache intensity reduced, and his left-sided motor function stabilized. However, he reported persistent emotional distress, feelings of guilt, and social withdrawal, prompting a psychiatric evaluation. A diagnosis of adjustment disorder with depressive symptoms was made, and he was started on sertraline (25 mg, increased to 50 mg) and lorazepam (0.5 mg at night as needed) to manage psychological symptoms.

A multidisciplinary Neuro-Oncology Tumor Board discussion was conducted, involving specialists from neurology, radiation oncology, neurosurgery, medical oncology, and psychiatry. Given the tumor size and significant peritumoral edema, fractionated SRT (3 × 9 Gy) was planned, while whole-brain radiotherapy (WBRT) was deemed unnecessary due to the absence of multiple metastases. Chemotherapy for systemic disease control was scheduled following completion of SRT.

Following SRT and dexamethasone tapering, the patient maintained

stable neurological function. A follow-up MRI at three months showed tumor size reduction and decreased perilesional edema, confirming a favorable response to treatment. Despite initial depressive symptoms, psychiatric support and family counseling helped improve his emotional well-being, and he continued systemic chemotherapy.

This case highlights the complex management of solitary BM from CRC in an eloquent brain region and the critical role of dexamethasone in relieving vasogenic edema and mass effect. The decision to pursue SRT over surgery was based on tumor location, neurological risk, and good Karnofsky Performance Score (KPS 90), emphasizing the importance of a multidisciplinary and patient-centered approach.

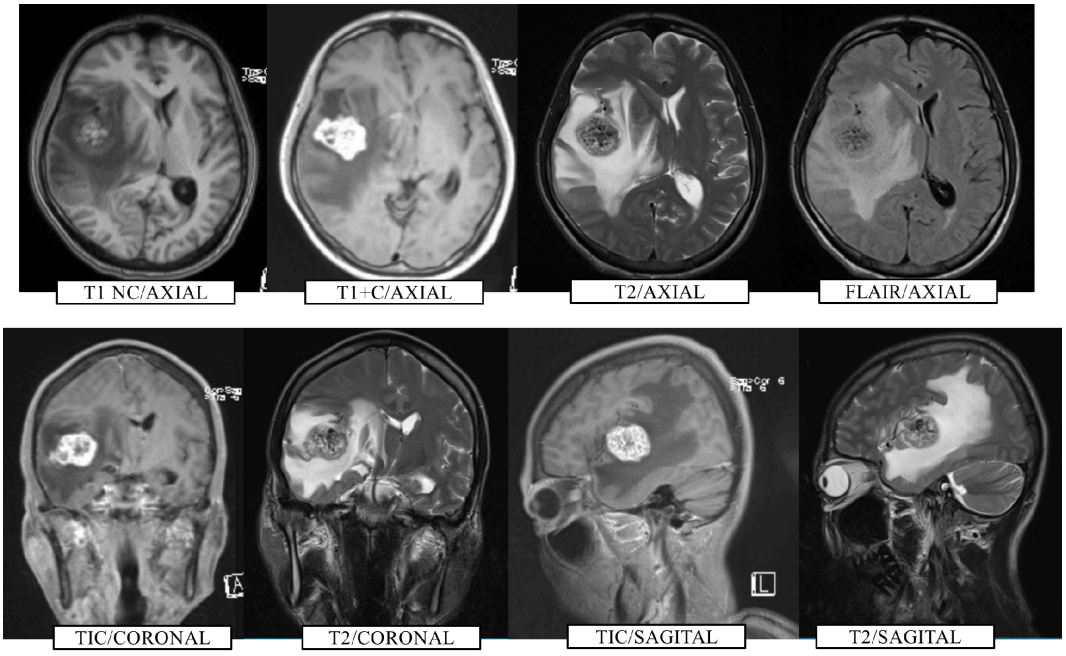

Figure 1. Collaged axial, sagittal, and coronal MRI sections showing a solitary right temporal lobe metastasis with perilesional edema and midline shift.

DISCUSSION

Brain metastases (BM) from colorectal cancer (CRC) are rare, with an incidence ranging from 0.6% to 3.2%, as CRC primarily metastasizes to the liver and lungs.[2] The presence of a solitary metastasis, as in this case, is even rarer and presents a unique

treatment challenge. The right temporal lobe, where the metastasis was located, is near the motor cortex and associated pathways, which control voluntary movement, making any intervention highly delicate.[5] The neurological deficits in this patient, including left-sided hemiparesis and central facial nerve paresis, were likely due to tumor-related mass effect and edema affecting descending motor fibers and corticospinal tracts.[6]

The mechanism of BM development in CRC is hematogenous spread, where circulating tumor cells penetrate the blood-brain barrier (BBB) and establish secondary growths.[11] The right temporal lobe, particularly near the corticospinal tract, is a susceptible site for metastasis due to its vascular supply and proximity to key motor pathways.[12] Once metastases form, they trigger peritumoral edema, further contributing to neurological dysfunction and intracranial hypertension.[13]

Clinical Presentation and Imaging Findings

The patient presented with progressive headaches, left-sided hemiparesis, and facial nerve palsy, symptoms indicative of tumor involvement near the corticospinal and cranial nerve pathway.[6] The worsening neurological deficits correlated with the tumor's size, edema, and mass effect.

MRI is the gold standard for diagnosing BM, providing superior soft-tissue contrast compared to CT.[3] In this case, axial, sagittal, and coronal MRI sections revealed a solitary intra-axial lesion in the right temporal lobe, with microbleeds and heterogeneous post-contrast enhancement, which is highly suggestive of BM rather than a primary brain tumor.[14] The lesion was adjacent to the motor pathways, explaining the patient's left-sided hemiparesis. The presence of perilesional edema, midline shift (1.2 cm), and compression of the basal ganglia, mesencephalon, and pons contributed to progressive motor dysfunction.[5]

The differential diagnosis included primary brain tumors

(glioblastoma, lymphoma) and other metastatic lesions, but the patient's history of stage IV rectal adenocarcinoma with systemic disease progression strongly supported the diagnosis of BM from CRC.[12] Studies indicate that patients with rectal primary tumors, lung metastases, and KRAS mutations are at higher risk of developing BM.[2] Screening for BM in CRC patients is generally reserved for those with neurological symptoms or high-risk features, as routine screening is not cost-effective.[2]

Management Approach: Role of Dexamethasone in Symptom Control

The management of solitary BM in eloquent regions near motor pathways is complex, requiring a multidisciplinary approach.[16] Surgical resection is typically considered for accessible, symptomatic solitary metastases, but in this case, the lesion's proximity to the motor cortex and descending tracts posed a high risk of permanent neurological deficits.[17]

Dexamethasone plays a critical role in the symptomatic management of BM, particularly in reducing vasogenic edema, which can significantly worsen motor symptoms by increasing intracranial pressure (ICP) and compressing motor pathways.[18] In this case, the patient was started on dexamethasone 10 mg IV twice daily, which led to partial neurological improvement and headache relief.[19] The dose was gradually tapered to avoid complications such as steroid-induced hyperglycemia, immunosuppression, and myopathy.[20]

Stereotactic Radiotherapy for Lesions in Eloquent Brain Regions

Given the lesion's location in an eloquent brain region and its proximity to critical motor pathways, stereotactic radiotherapy (SRT) was selected over surgery.[21] SRT delivers precise, high-dose radiation to the tumor while sparing surrounding healthy brain tissue, reducing the risk of permanent neurological impairment.[22]

Whole-brain radiotherapy (WBRT) was avoided due to the absence of multiple metastases, as WBRT is associated with cognitive decline and lower quality of life.[23] The patient underwent fractionated SRT (3 × 9 Gy), which allowed for controlled tumor response while minimizing damage to adjacent motor pathway.[24]

Neuropsychiatric Considerations and Supportive Care

Patients with brain metastases frequently experience psychological distress, including adjustment disorders and depression, which can significantly impact treatment adherence and quality of life.[7] This patient exhibited emotional distress, guilt, and social withdrawal, requiring psychiatric intervention. He was started on sertraline (initially 25 mg, increased to 50 mg) and lorazepam (0.5 mg at night as needed) to manage depressive symptoms and sleep disturbances.[8] Psychosocial support, including counseling for both the patient and his family, was crucial in improving his emotional well-being and treatment compliance.[9] The involvement of a neuropsychiatry team allowed for a more comprehensive, patient-centered approach to care.[10]

Advanced Care Planning and Prognosis

Given the advanced nature of the disease and the likelihood of progression, Advanced Care Planning (ACP) was discussed with the patient and his family. ACP involves defining treatment goals, discussing possible disease trajectories, and making decisions about future care preferences.[25] This included discussions on palliative options, symptom management, and resuscitation preferences in the event of further deterioration.[26] The goal of ACP is to align medical care with the patient's values and quality-of-life considerations, ensuring that future treatment choices respect the patient's wishes.

The prognosis of BM from CRC is generally poor, with median survival ranging from 3 to 12 months, depending on factors such as performance status, extent of

systemic disease, and response to therapy. However, in this case, the patient had a good Karnofsky Performance Score (KPS 90), solitary metastasis, and controlled systemic disease, making him a good candidate for aggressive local treatment with SRT.[27]

Follow-up MRI at three months showed tumor size reduction and decreased perilesional edema, confirming a favorable response to therapy. Given the lesion's proximity to motor pathways, long-term monitoring is essential. Regular MRI every 2–3 months will assess for tumor recurrence or new metastatic lesions, as further tumor growth could cause permanent motor deficits.[17] If progression occurs, systemic therapy, re-irradiation, or palliative care options would be considered.[28]

CONCLUSION

Solitary brain metastases from colorectal cancer (CRC) are rare, and their management is challenging, especially when located in eloquent brain regions like the temporal lobe near the motor cortex. This case highlights the importance of correlating neurological deficits with tumor location, as well as the role of stereotactic radiotherapy (SRT) in preserving neurological function when surgery poses a high risk. Dexamethasone effectively reduced peritumoral edema, improving symptoms, while multidisciplinary care, including neuro-oncology and psychiatric support, played a crucial role in optimizing outcomes. This case underscores the need for early diagnosis, individualized treatment planning, and ongoing follow-up to guide further management and improve patient quality of life.

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