

Case Report

Colorectal cancer metastasis to the brainstem: A single case report

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ABSTRACT

Background: Colorectal cancer (CRC) is among the most widely prevalent malignancies afflicting increasingly high numbers of the population worldwide. Metastases majorly involve the liver and lungs but are not unheard of in the brain. Only one case has so far been reported to occur in the brainstem, excluding this one.

Case Description: We report a second case of an 85-year-old male who presented with headaches and difficulty swallowing and was found to have a right anterior pontine lesion extending into the midbrain on magnetic resonance imaging of the brain and cecal adenocarcinoma on subsequent colonoscopy. The pontine lesion was biopsied and confirmed to be a metastatic lesion. He underwent a course of radiotherapy and tolerated it well, with improvement of his presenting symptoms.

Conclusion: CRC-related morbidity and mortality are on the rise, as is expected with the incidence of metastases to the brain, including the brainstem, which is an extremely rare site for such metastases. This case illustrates such an encounter and the possibility of early detection of these metastases through brain imaging of patients with known or suspected CRC and symptoms of neurologic dysfunction. The current preferred management is surgical resection when possible, with or without radiotherapy. However, due to the rarity of the case, more data might be required to make more accurate decisions in these cases.

Keywords: Brain metastases, Brainstem metastases, Colorectal cancer

INTRODUCTION

Colorectal cancer (CRC) is the most prevalent malignancy that affects humans after breast and lung cancer and is the second cause of cancer deaths after lung cancer worldwide as of 2020.^[9] In the Eastern Mediterranean region (EMRO), though, the incidence and mortality rates seem to be among the lowest.^[9] Metastases to the brain are far more heard of with lung and breast cancers than with CRC, which are estimated to be only about 1–3% and usually present in the late stages after having metastasized to other sites, including the lungs and liver.^[3,4,11] Even among those, brainstem metastases have never been reported in the literature aside from just one case.^[5] From another perspective, brainstem metastases, in general, comprise 3–7% of all brain metastases (BM) from primary lung (44.9%), breast (20.2%), melanomas (10%), renal cell or genitourinary (7.5%), and gastrointestinal (4.5%) cancers, in descending order as stated.^[7] In this text, we report a case of an 85-year-old male patient who presented for headaches of 1-month duration. Magnetic resonance imaging (MRI) of the brain showed a 1.5-cm lesion in the pons on the right extending into the

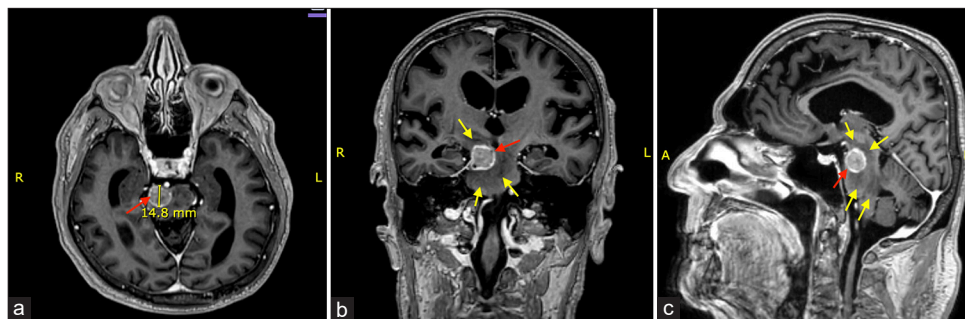


Figure 1: T1-weighted magnetic resonance imaging of the brain with gadolinium (a: axial; b: coronal; c: sagittal) showing a $1.6 \times 1.7 \times 1.8$ cm enhancing lesion (red arrows) in the right anterior aspect of the pons, extending superiorly to the midbrain and cerebral peduncle, with small cystic components measuring up to 4 mm and predominant rim enhancement, significant surrounding edema (yellow arrows) in the brainstem extending to the right superior, middle cerebellar peduncles and right cerebellum, and superiorly to the right thalamus and posterior limb of the right internal capsule, with no other focus of abnormal enhancement in the brain, midline shift or herniation.

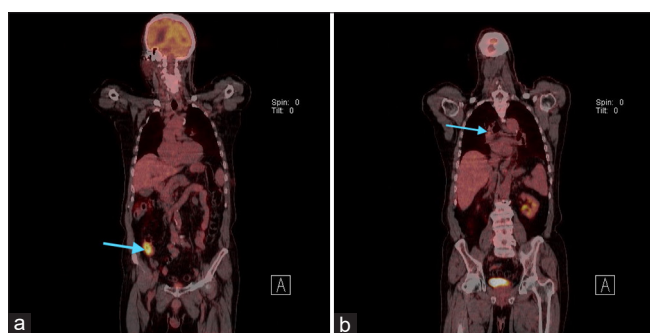


Figure 2: Positron emission tomography-computed tomography, coronal cuts, showing cecal thickening (a; blue arrow) with a standardized uptake volume of 14.6, and a mildly active right hilar lymph node (b; blue arrow) with a standardized uptake volume of 5.5.

midbrain with extensive edema suspicious of a metastatic lesion. Colonoscopy thereafter revealed a large cecal mass. He underwent a stereotactic biopsy of the lesion, which confirmed cecal adenocarcinoma metastasis to the brainstem. He received radiotherapy and is doing well so far.

CASE PRESENTATION

The patient is an 85-year-old male with a history of an old embolized cerebral aneurysm and prostatic cancer post radiotherapy and a family history of colon cancer in a 75-year-old brother, who presented for headaches around a month before presentation. He also reported difficulty swallowing. MRI of the brain revealed a 1.5-cm, ring-enhancing lesion in the anterior superior aspect of the pons with extension into the midbrain and extensive edema [Figure 1].

The possibility of the lesion being metastatic was raised, so he underwent a positron emission tomography-computed tomography, which in turn showed a mildly active 1-cm right

hilar lymph node with a standardized uptake value of 5.5 and focal cecal thickening with a standardized uptake value of 14.6 [Figure 2]. Recent laboratory investigations revealed a decreased hemoglobin of 8.9 g/dL. A colonoscopy was done revealing a large fungating mass in the cecum with the biopsy consistent with an invasive, moderately differentiated colonic adenocarcinoma.

He was taking prednisone 10 mg twice daily. It was stopped about a week before the operation. He was neurologically intact aside from mild left-sided weakness.

He underwent a right frontal burr hole for stereotactic navigation-assisted biopsy of the brainstem lesion. Under general anesthesia and lying supine with his head fixed in a Mayfield's head clamp in the midline position, the safest trajectory was determined using stereotactic image-guided localization. After proper sterilization of the frontal area, the skin was opened with a short lazy S-shaped incision, and a Burr hole was made. The dura and cortex were opened, and the edges coagulated. Several biopsies were taken with a biopsy needle under navigation. Hemostasis was then achieved using bipolar coagulation and gel foam, and the Burr hole was filled back with the bone dust preserved from drilling. The wound was closed neatly and the patient was extubated and left the operating room in good condition.

Postoperatively, he had significant left-sided weakness and a mild left central facial palsy, which improved later on steroids.

A postoperative computed tomography of the brain was done and showed expected postsurgical changes [Figure 3].

He was discharged the next day on a 2-week dexamethasone taper and pain medications with instructions for follow-up. Later, the biopsy confirmed metastatic colonic adenocarcinoma [Figure 4]. Further studies revealed a Kirsten Rat Sarcoma viral oncogene homolog (KRAS) G12C mutation.

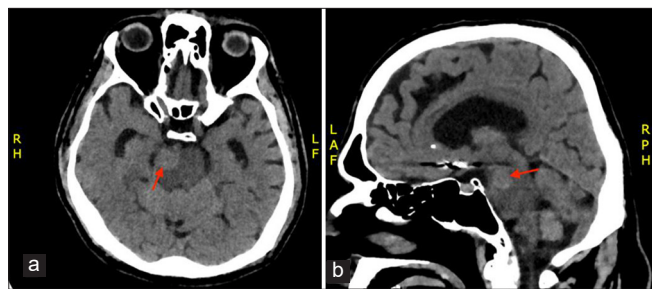


Figure 3: Postoperative CT of the brain (a: axial; b: sagittal) without contrast showing expected postsurgical changes, a grossly intact brainstem lesion (red arrows) and a prior embolization of an anterior communicating artery aneurysm.

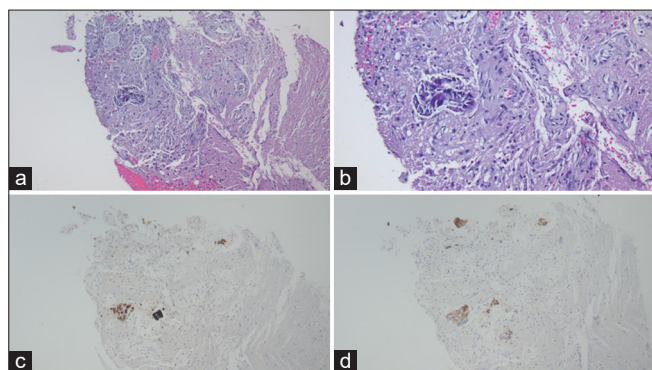


Figure 4: (a) Hematoxylin and eosin staining (×100) and (b) (×200) showing rare glandular tumor cells consistent with metastatic colonic adenocarcinoma, (c) caudal type homeobox 2 (CDX2) (×100), and (d) cytokeratin (CK) 20 (×100), also consistent with metastatic colorectal adenocarcinoma.

He tolerated a course of stereotactic radiotherapy well, with good improvement in his dysarthria and ambulation. The course was delivered over 15 sessions spanning 21 days with a 2.67-Gray fractional dose for each session, concluding at a total dose of 40.05 Gray. He will be following up with his oncologist with a repeat MRI in 2–3 months.

DISCUSSION

In 2020, the worldwide incidences of CRC exceeded 1.9 million new cases, and an estimated 0.9 million died of CRC. The International Agency for Research on Cancer statistics stated that the lowest of these mortalities belonged to the EMRO (5.3/100,000) and that the incidence rates were among the lowest internationally (9.1/100,000), with only Guinea and the African region scoring the least numbers of cases. Moreover, they estimated a 63.3% rise in cases worldwide by 2040, with the greatest increases in developing countries, including the EMRO, which was estimated to have a 92% increase in new cases by that time.^[9]

BM from primary lung and breast malignancies reached 39–50% and 17–30%, respectively, in 2023;^[3] however, CRC

BM accounts for only about 1–3% of CRC metastases. They tend to occur more in males, with a preference to originate from the left colon and precipitate in the cerebellum, gray-white matter junction, and watershed areas.^[4,10] They are also rarely isolated and usually occur in the late stages (III–IV) at diagnosis after other sites, mostly the liver and lungs, have already had their share of metastases.^[11] This is supported by Lee *et al.*, who mentioned BM took around 18 months from diagnosis of CRC to occur, but liver and lung metastases took 6.5 and 11 months, respectively.^[8] Our patient's pulmonary lymph node with high uptake may have represented lung metastasis, but it was not sampled at the time. It is believed that the disease is spread through the hematogenous route, much like how an embolus travels.^[6] Moreover, studies on the topic, including its genetics, showed poorer prognoses with RAS/RAF mutations than with wild types.^[4] Our patient had a KRAS mutation, indicating a poor prognosis.

The survival median after developing BM accounts for <6 months, as reported by Gordon *et al.*^[4] Others reported survival periods as low as 1–2 months, but with the advancement of therapies targeting the primary as well as metastatic lesions, these periods have been reaching an average of 4–12 months.^[8] In one of the largest multi-center, multi-national analyses done so far on patients with brainstem metastases in specific and who were treated with radiosurgery (RS), the median survival of untreated brainstem metastases improved from 1 month to 5.6 months after RS, with a 32.7% 1-year survival.^[7]

Surgical resection of CRC BM has been shown to increase survival rates more than whole-brain radiotherapy (WBRT). However, even with surgery, there exists a risk of recurrence, which raised the possibilities of benefit from postoperative radiotherapy as well, either by WBRT or RS.^[1] Chemotherapeutic agents, in general, are not so permeable despite the blood–brain barrier disruption described in metastatic disease, yet Lee *et al.* found that multimodal therapy, including bevacizumab, increased overall survival to around 20.6 months. So far, a Karnofsky Performance Scale (KPS) ≥ 70 and multimodal therapy remain prominent independent prognostic factors for the condition discussed.^[8] Our patient was still able to carry out daily tasks with some right-side weakness with minimal to no assistance, granting him a KPS score of 70–80 points, which correlates to an Eastern Cooperative Oncology Group score of 1. As such, he was an eligible candidate for RS. Chen *et al.*'s review of the safety and efficacy of RS for brainstem metastases observed a rate of 55% for symptom improvement, 86% local cure rate, and low risk for severe toxicity (2.4%). They also noted neurologic death rates similar to those in patients with general BM treated with stereotactic RS. Only 2.7% of deaths directly caused by the brainstem lesions themselves were observed.^[2]

Our patient has just recently undergone a biopsy only for eloquence of the area, plus radiotherapy. He is still under close follow-up despite the prognosis, primarily with his oncologist, to determine the next steps in therapy. Unfortunately, data concerning BM from CRC are still very limited due to the low incidence rates and even more sparse for the brainstem, with only one previously reported CRC BM from the rectum to the medulla oblongata described by Lakra *et al.*^[5] In their case, the patient was a young male in his late 20s who presented for apneic spells, which was part of the reason they went for a more aggressive treatment with a longer and more complicated hospital stay than our 85-year-old patient.

Needless to mention, early diagnosis and treatment of CRC might slow the progression to BM. Similarly, any patient with known or suspected CRC presenting with neurologic symptoms, including headaches, weakness, seizures, behavioral changes, coordination or speech disturbances, or bulbar symptoms, may benefit from MR imaging of the brain to detect the presence of BM in the brainstem or other brain structures. This might, in turn, improve the outcomes of these patients with early diagnosis of CRC.

CONCLUSION

The burden of CRC in both morbidity and mortality is expected to dramatically increase despite the improved survival. As such, it is safe to assume that BMs in this context are to be encountered more frequently from here on out. This case illustrates a very rare occurrence of cecal adenocarcinoma metastasis to the pons and midbrain in particular, causing headaches and difficulty swallowing in an 85-year-old male. Brain imaging is advocated in suspected or confirmed CRC cases to screen for BM, especially with the concurrence of neurologic symptoms. Surgical resection is by far the superior treatment modality, with or without radiotherapy, but more comparable data are needed to refine this judgment given the rarity of the case.

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REFERENCES

1. Chang Y, Wong CE, Lee PH, Huang CC, Lee JS. Survival outcome of surgical resection vs. Radiotherapy in brain metastasis from colorectal cancer: A meta-analysis. *Front Med (Lausanne)* 2022;9:768896.
2. Chen WC, Baal UH, Baal JD, Pai JS, Boreta L, Braunstein SE, *et al.* Efficacy and safety of stereotactic radiosurgery for brainstem metastases: A systematic review and meta-analysis. *JAMA Oncol* 2021;7:1-9.
3. Gomez D, Feng JJ, Cheok S, Shah I, Dicharry H, Cote DJ, *et al.* Incidence of brain metastasis according to patient race and primary cancer origin: A systematic review. *J Neurooncol* 2024;169:457-6.
4. Gordon C, Cecchini M, Lacy J. Survival and clinical characteristics of patients with colorectal cancer and brain metastases. *J Clin Oncol* 2023;41(4_suppl):29.
5. Lakra R, Bouchette P, Rana M, Kulkarni S. Rectum to medulla oblongata: Colorectal cancer metastasizing to the brainstem. *Cureus* 2023;15:e39738.
6. Lassman AB, DeAngelis LM. Brain metastases. *Neurol Clin* 2003;21:1-23.
7. Lee JY, Cunningham DA, Murphy ES, Chao ST, Suh JH. Optimal management of brainstem metastases: A narrative review. *Chin Clin Oncol* 2022;11:15.
8. Li W, Wang T, Zhu Y, Yu H, Ma L, Ding Y, *et al.* Brain metastasis from colorectal cancer: Treatment, survival, and prognosis. *Medicine (Baltimore)* 2022;101:e30273.
9. Roshandel G, Ghasemi-Kebria F, Malekzadeh R. Colorectal cancer: Epidemiology, risk factors, and prevention. *Cancers (Basel)* 2024;16:1530.
10. Tagayasu Y, Miyamoto Y, Sawayama H, Ogawa K, Kato R, Yoshida N, *et al.* Rectal cancer was diagnosed after resection of isolated brain metastasis. *Surg Case Rep* 2022;8:52.
11. Tan WS, Ho KS, Eu KW. Brain metastases in colorectal cancers. *World J Surg* 2009;33:817-21.

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