

## Whole-body <sup>18</sup>F-Fluorodeoxyglucose Positron Emission Tomography/Computed Tomography Demonstrating Multiple Rare Extracranial Metastases in a Treated Case of Glioblastoma

### Abstract

Glioblastoma (GBM) is the most aggressive primary brain tumor in adults that accounts for nearly 20% of all primary malignant brain tumors. While GBM is notable for local recurrence and invasion, extracranial metastases (ECMs) are exceedingly rare, occurring in <2% of patients. However, the report of <sup>18</sup>F-fluorodeoxyglucose positron emission tomography/computed tomography (<sup>18</sup>F-FDG PET/CT) imaging in evaluating ECM is limited, and the importance of whole-body FDG PET/CT imaging in GBM has not been well elucidated. We present here a case of GBM, post excision 12 years before, whole-body <sup>18</sup>F-FDG PET/CT showing no recurrence in the brain and ECM to multiple bones, right kidney, and pancreas.

**Keywords:** <sup>18</sup>F-fluorodeoxyglucose positron emission tomography/computed tomography, extracranial metastases, glioblastoma, whole body

A 41-year-old man underwent right parietal lesion excision in 2010 which showed WHO grade II fibrillary astrocytoma and radiotherapy was given. He had multiple recurrences in the brain, last biopsy done in 2013 showed glioblastoma (GBM) WHO grade IV, and underwent surgery and radiotherapy. He presented with right hip pain and difficulty in walking in 2021. Magnetic resonance imaging showed a large lesion in the right femur, for which he underwent removal of the lesion and right hip prosthesis. Biopsy showed GBM metastases. He was referred for <sup>18</sup>F-fluorodeoxyglucose positron emission tomography/computed tomography (<sup>18</sup>F-FDG PET/CT) to rule out extracranial metastases (ECMs) whole-body PET/CT [maximum intensity projection Figure 1a] showed intensely hypermetabolic lesions in the body of the pancreas [Figure 1b], lower pole of the right kidney [Figure 1c], and multiple bone lesions including a left humerus and multiple ribs [left iliac bone Figure 1d]. Brain PET [Figure 2] showed no recurrent brain lesion.

GBM is the most aggressive primary brain tumor and despite standard treatment with surgery, radiotherapy, and chemotherapy

with temozolomide, the median survival time for GBM is only 15 months.<sup>[1]</sup> ECM of GBM is rare, with a reported incidence of about 0.4% to 2.0%.<sup>[2]</sup> The prognosis of metastatic GBM is poor, with median overall survival from diagnosis of metastasis of 6.0 ± 0.8 months.<sup>[3]</sup>

The rarity of ECM is attributed to the short survival period, presence of blood-brain barrier, and the lack of a classic lymphatic drainage system. In a recent meta-analysis by Cunha and Maldaun<sup>[4]</sup> of 114 cases of metastatic GBM, most cases involved metastases in a single organ or site, and to the best of our knowledge, only 12 cases of GBM multisite metastases have been described with or without intracranial recurrence. The most common metastatic sites include lungs, pleura, lymph nodes, liver, skin, scalp, parotid gland, spleen, pancreas, bowel mesentery, peritoneum, epidural space, and bones. Piccirilli *et al.*<sup>[5]</sup> reported that common metastatic sites included lungs and pleura (60%), lymph nodes (51%), and bones.

However, the report of <sup>18</sup>F-FDG PET/CT imaging in evaluating ECM is limited, and the importance of whole-body <sup>18</sup>F-FDG PET/CT imaging in ECM has not been well elucidated.<sup>[6,7]</sup> Mirzayan *et al.* reported the

**Koramadai  
Karuppusamy  
Kamaleshwaran,  
Elumalai  
Ramkumar,  
Madhu Sairam  
Raghunathan<sup>1</sup>**

Departments of Nuclear  
Medicine, PET/CT and  
Radionuclide Therapy and  
<sup>1</sup>Radiotherapy, Kovai Medical  
Center and Hospital Limited,  
Coimbatore, Tamil Nadu, India

### Address for correspondence:

Dr. Koramadai Karuppusamy  
Kamaleshwaran,  
Department of Nuclear  
Medicine, PET/CT and  
Radionuclide Therapy, Kovai  
Medical Center and Hospital  
Limited, Coimbatore - 641 014,  
Tamil Nadu, India.  
E-mail: dr.kamaleshwar@gmail.  
com

Received: 29-09-2022

Revised: 26-12-2022

Accepted: 27-12-2022

Published: 10-10-2023

### Access this article online

Website: www.ijnm.in

DOI:10.4103/ijnm.ijnm\_167\_22

### Quick Response Code:



**How to cite this article:** Kamaleshwaran KK, Ramkumar E, Raghunathan MS. Whole-body <sup>18</sup>F-fluorodeoxyglucose positron emission tomography/computed tomography demonstrating multiple rare extracranial metastases in a treated case of glioblastoma. Indian J Nucl Med 2023;38:294-6.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow\_reprints@wolterskluwer.com

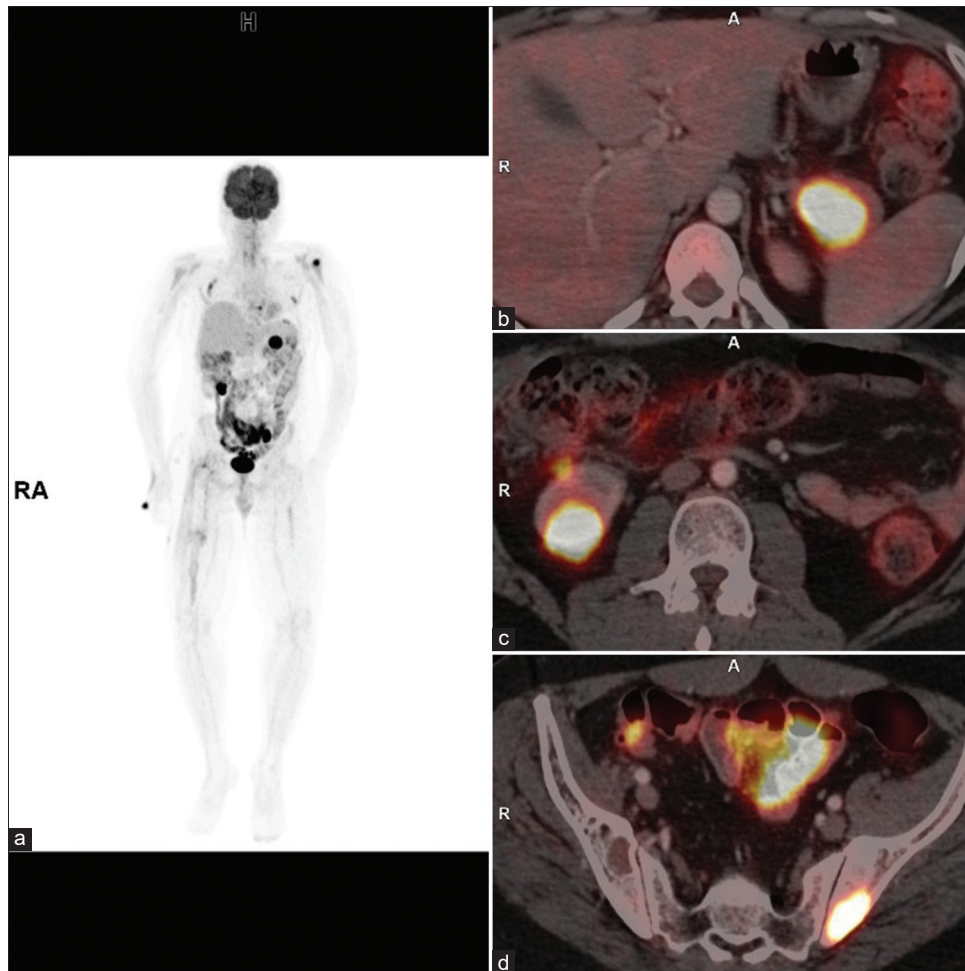


Figure 1: Whole-body MIP (a) axial fused  $^{18}\text{F}$ -FDG PET/CT image showing pancreatic lesion (b) right kidney lesion (c), and right iliac bone lesion (d). MIP: Maximum intensity projection,  $^{18}\text{F}$ -FDG PET/CT:  $^{18}\text{F}$ -fluorodeoxyglucose positron emission tomography/computed tomography

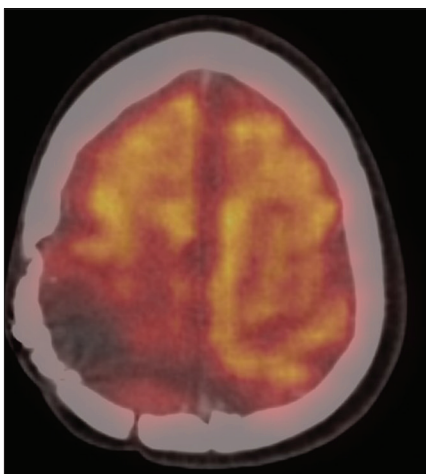


Figure 2:  $^{18}\text{F}$ -FDG-fused PET/CT brain image showing no recurrence.  $^{18}\text{F}$ -FDG:  $^{18}\text{F}$ -fluorodeoxyglucose, PET/CT: Positron emission tomography/ computed tomography

usefulness of whole-body  $^{18}\text{F}$ -FDG PET/CT in detecting ECM in GBM.<sup>[8]</sup> In our case, the patient developed ECM in bone after 11 years and underwent surgery and radiotherapy.  $^{18}\text{F}$ -FDG PET/CT showed ECM to the

pancreas and kidney which is rare along with multiple skeletal metastases.

In conclusion, long-term survivors of GBM may be at increased risk of developing ECM. Rigorous follow-up should be carried out in patients with GBM with  $^{18}\text{F}$ -FDG PET/CT whole body and aggressive locoregional and systemic treatments are necessary to reduce recurrence and metastasis and prolong survival.

#### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name and initials will not be published and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

#### Financial support and sponsorship

Nil.

#### Conflicts of interest

There are no conflicts of interest.

## References

1. Stupp R, Mason WP, van den Bent MJ, Weller M, Fisher B, Taphoorn MJ, *et al.* Radiotherapy plus concomitant and adjuvant temozolomide for glioblastoma. *N Engl J Med* 2005;352:987-96.
2. Hamilton JD, Rapp M, Schneiderhan T, Sabel M, Hayman A, Scherer A, *et al.* Glioblastoma multiforme metastasis outside the CNS: Three case reports and possible mechanisms of escape. *J Clin Oncol* 2014;32:e80-4.
3. Liu J, Shen L, Tang G, Tang S, Kuang W, Li H, *et al.* Multiple extracranial metastases from glioblastoma multiforme: A case report and literature review. *J Int Med Res* 2020;48:1-10.
4. Cunha ML, Maldaun MV. Metastasis from glioblastoma multiforme: A meta-analysis. *Rev Assoc Med Bras* (1992) 2019;65:424-33.
5. Piccirilli M, Brunetto GM, Rocchi G, Giangaspero F, Salvati M. Extra central nervous system metastases from cerebral glioblastoma multiforme in elderly patients. Clinico-pathological remarks on our series of seven cases and critical review of the literature. *Tumori* 2008;94:40-51.
6. Li ZG, Mu HY. Extracranial bone metastases from recurrent anaplastic astrocytoma on FDG PET/CT: A case report a care-compliant article. *Medicine (Baltimore)* 2017;96:e7123.
7. Kay MD, Pariury HE, Perry A, Winegar BA, Kuo PH. Extracranial metastases from glioblastoma with primitive neuronal components on FDG PET/CT. *Clin Nucl Med* 2020;45:e162-4.
8. Mirzayan MJ, Samii M, Petrich T, Börner AR, Knapp WH, Samii A. Detection of multiple extracranial metastases from glioblastoma multiforme by means of whole-body [18F] FDG-PET. *Eur J Nucl Med Mol Imaging* 2005;32:853.