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Intramedullary spinal cord metastases in breast cancer discovered on fluorodeoxyglucose-positron emission tomography-computed tomography

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ABSTRACT

Breast cancer ranks among the most prevalent solid tumors that may metastasize to multiple sites but less commonly to intramedullary spinal cord metastases. It represents perhaps the rarest form of central nervous system involvement stemming from breast cancer, with only sporadic cases documented in the literature. We represent a case of a female patient with right breast cancer treated, then was lost of sight, she presented after 8 months with worsening general condition. Fluorine-18 fluorodeoxyglucose (¹⁸F-FDG) PET/CT revealed a pathological hypermetabolic mass in the right breast associated with multiple intramedullary pathological hypermetabolic foci were found disseminated over the spinal cord of the cervical, dorsal, and lumbar spine. Breast cancer is the second most prevalent primary tumor causing this type of metastasis, following lung cancer. ¹⁸F-FDG PET/CT is currently the primary imaging technique for whole-body screening for metastases, and thus can ideally detect most sites of metastasis, including those within the spine. Several studies have demonstrated that PET/CT combines the high sensitivity of PET for detection with the accurate anatomical localization provided by CT. In specific contexts, such as instances of contraindication to MRI, PET may serve as an alternative for assessing intramedullary spinal cord metastases.

Keywords: ¹⁸F-FDG PET/CT, intramedullary spinal cord metastases, breast cancer

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Introduction

Breast cancer ranks among the most prevalent solid tumors and remains a significant public health concern globally. Invasive ductal carcinoma commonly metastasizes to the lung, liver, bone, and brain. Additionally, lobular carcinoma, besides these usual sites, may metastasize to less common locations such as the peritoneum, gastrointestinal tract, and ovary [1]. Intramedullary

spinal cord metastasis (ISCM) is probably the rarest form of involvement of the central nervous system caused by breast cancer, with few sporadic cases documented in the literature. Early detection holds crucial importance as ISCMs indicate a poor prognosis and timely treatment may mitigate neurologic deterioration [2]. This article presents a rare case of a patient with ISCMs originating from breast cancer, as documented by positron emission tomography-computed tomography (PET/CT).

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Case presentation

We report a case of a 54-year-old woman with triple-negative infiltrating ductal carcinoma of the right breast cancer initially classified T2N2M0 and treated with neoadjuvant chemotherapy containing anthracyclines and taxanes, followed by surgery. However, the patient was lost to follow-up and presented 8 months later in worsened general condition, with weight loss and diffuse back pain resistant to analgesic treatment. She was then referred to our nuclear medicine department for evaluation.

Positron emission tomography-computed tomography performed after injection of 3MBq/Kg of fluorine-18 fluorodeoxyglucose (^{18}F -FDG) revealed a pathological hypermetabolic mass in the right breast associated with small hypermetabolic foci scattered over the mammary gland. Additionally, multiple intramedullary pathological hypermetabolic foci were found disseminated over the spinal cord of the cervical, dorsal, and lumbar spine. Pathological hypermetabolic foci were also observed in the brain and abdominopelvic foci and raised suspicion of peritoneal implants. Furthermore, small, and slightly hypermetabolic liver foci were detected in the hepatic dome, segment IV, and segment VI, along with hypermetabolic lymph nodes in the cervical, right axillary, mediastinal, and bilateral pulmonary hilar regions (Fig. 1).

Discussion

Intramedullary spinal cord metastases represent a relatively rare manifestation of systemic malignant tumors. According to various studies, they are found in about 2% of autopsy cases and have an incidence of 8.5% among CNS metastases [1]. Depending on the study, ISCM comprises 0.8–3.9% of symptomatic spinal cord metastases [3]. Breast cancer is the second most prevalent primary tumor causing this type of metastasis, following lung cancer. ISCMs can affect any part of the spinal cord, with the cervical level most commonly affected, likely due to its larger size and rich blood supply [4]. Common initial symptoms include pain and/or weakness. In most cases, neurological function deteriorates rapidly over days to weeks. Around half of patients progress to cord hemisection syndrome or cord transection [5].

Three pathogenic mechanisms have been suggested for ISCM. For most cases, the cause is probably hematogenous spread through the arterial route or the vertebral venous plexus. The second mechanism is related to meningeal carcinomatosis. The third mechanism is direct invasion of adjacent structures. Although the dura mater protects the spinal cord from malignant tumors, metastatic tumors may spread directly to the spinal cord from the epidural space of the spinal cord or nerve roots through the dura mater and spread along the perineural spaces to the subarachnoid space and spinal cord parenchyma [4].

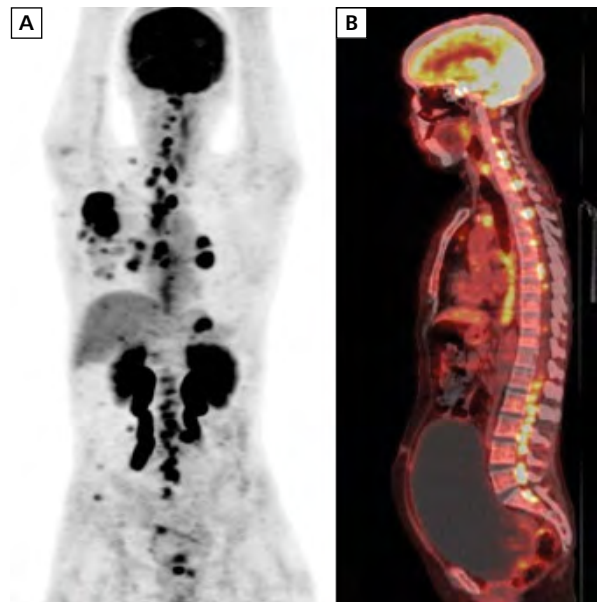


Figure 1. Whole body fluorine-18 fluorodeoxyglucose (^{18}F -FDG) positron emission tomography-computed tomography (PET/CT) (A) maximum intensity projection (B) fused coronal PET/CT, showing diffuse multiple intramedullary pathological hypermetabolic foci disseminated over the spinal cord of the cervical, dorsal, and lumbar spine

Contrast-enhanced magnetic resonance imaging (MRI) of the entire spine or at the suspected level is considered the preferred imaging modality for patients with known malignancy and suspected spinal canal disease [6].

However, ^{18}F -FDG PET/CT may be currently the mainstay imaging technique for whole-body metastasis screening and thus can ideally detect most sites of metastasis, including those within the spine. Although there are isolated case reports of ISCMs visualized by PET, large-scale studies systematically evaluating ^{18}F -FDG PET/CT for ISCM detection have not been reported [7]. ^{18}F -FDG PET/CT plays a role in assisting in the diagnosis of ISCM by providing information about metabolic activity and ruling out other diagnostic considerations [4].

Reports of ISCMs are rare, and documented cases of the incidence of ISCM in breast cancer are lacking [8]. Several studies have shown that PET/CT, especially when using ^{18}F -FDG, allows for examination of the entire spinal cord, facilitating ISCM detection [9]. Previous research on intraspinal tumors, such as stromal astrocytomas and ventricular meningiomas, has confirmed the feasibility of PET/CT in detecting intradural lesions and improving diagnostic efficiency [10]. In addition, related studies have shown that PET/CT combines the high detection sensitivity of PET and the precise anatomical positioning of CT to simultaneously evaluate soft tissue involvement [11].

This dual function is particularly valuable in diagnosing intradural and vertebral metastases because it has higher sensitivity than MRI and provides more comprehensive imaging information for clinical diagnosis and therapeutic decisions [10].

Managing ISCMs presents a challenging clinical scenario with no clear guidelines available. Treatment decisions are generally based on the doctor's experience and the patient's performance status. Therapeutic options range from surgical excision and external beam radiation therapy to chemotherapy or palliative care [12].

Like with other metastasis to the central nervous system, ISCM patients have a poor prognosis and short survival. The median life expectancy is 3 to 4 months from the date of diagnosis. Patients with breast cancer as the primary cause of ISCM, tend to fare better than patients with other cancers. Their median survival is 7.25 ± 8.08 months [13].

Conclusions

The current case of metastatic breast carcinoma with the development of ISCMs underscores the ominous nature of ISCMs as an indicator of systemic malignancy. While life expectancy is limited, timely diagnosis and intervention can significantly ameliorate neurological deficits and overall quality of life. Fluorine-18 fluorodeoxyglucose PET/CT emerges as a valuable diagnostic tool, offering high sensitivity and accuracy for qualitative analysis and differentiation. In specific contexts, such as instances of contraindication to MR imaging, PET may serve as an alternative for assessing ISCMs.

Article Information and Declarations

Ethics statement

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Author contributions

M.O.: concept, design, data collection and processing, analysis, literature search and writing; Y.B., O.A.S., S.O.N., A.D.: design and literature search.

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Conflict of interest

Authors declare no conflicts of interests.

Supplementary material

None.

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