

## An Unusual Case of Urothelial Carcinoma of Bladder with Metastasis to Brain and Skeletal Muscles Evaluated on 18F-Fluorodeoxyglucose Positron Emission Tomography/Computed Tomography

### Abstract

Urothelial or transitional cell carcinoma is the most prevalent variant of urinary bladder carcinoma worldwide occurring in both men and women. There are a very few cases described in the literature with metastasis to skeletal muscles and even fewer cases with metastatic site in the brain. We present a case of high-grade urothelial carcinoma with metastasis to the left temporal lobe as well as multiple inter- and intra-muscular deposits in the left thigh.

**Keywords:** Brain metastasis, inter/intra-muscular deposits, urothelial carcinoma

A 72-year-old man, case of high-grade urothelial carcinoma of the urinary bladder, underwent trans-urethral resection of bladder tumor and intravesical Bacille Calmette Guerin treatment followed by chemotherapy (gemcitabine and carboplatin). He developed retroperitoneal nodal recurrence after few months, for which he received further three cycles of chemotherapy (carboplatin, paclitaxel, and trastuzumab). During chemotherapy, he complained of imbalance while walking. The patient was referred to our department for fluorodeoxyglucose positron emission tomography/computed tomography (FDG PET-CT) scan to assess for disease status. Scan was performed 60 min after intravenous injection of 5.6 mCi of 18F-FDG. 18F-FDG PET-CT [Figure 1a] maximum intensity projection image and [Figure 1b] fused coronal image showed retroperitoneal nodal disease and intermuscular deposit in the left popliteal region. CCT and fused PET-CT showed [Figure 1c] new-onset metastatic cystic brain lesion in the left temporal lobe with FDG avidity and enhancement along its periphery (arrow) [Figure 1d and 1e] and FDG avid intermuscular deposits between the muscles of posterior compartment of the left thigh (arrow). Magnetic resonance imaging (MRI) brain findings corroborated with PET-CT scan, with detection of two

other tiny lesions in brain. The patient underwent left temporal craniotomy and decompression, followed by gamma knife surgery of the brain metastasis. Histopathological findings confirmed metastatic urothelial carcinoma. There was some improvement in speech of the patient postsurgery.

In urinary bladder neoplasm, metastatic spread may occur directly into adjacent pelvic structures, via lymphatic route into pelvic-retroperitoneal nodes or via hematogenous route commonly to lungs (45%), liver (47%), bone (32%), and peritoneum.<sup>[1,2]</sup> The incidence of brain metastasis is rare (<1%); however, skeletal muscle involvement is extremely unusual and associated with advanced bladder cancer.<sup>[3,4]</sup> Muscle tissue is known to demonstrate high resistance to cancer cells, which is attributed to many factors such as high contractile activity, pH changes, oxygenation, accumulation of lactic acid, and other metabolites.<sup>[5]</sup> Carcinomas of pelvic organs such as urothelial urinary bladder carcinomas can metastasize to brain even without lung metastasis through the vertebral venous plexus since epidural and vertebral venous blood flow may anatomically communicate with veins of thoracic-abdominal cavity and central nervous system.<sup>[1,6]</sup> Brain metastasis has

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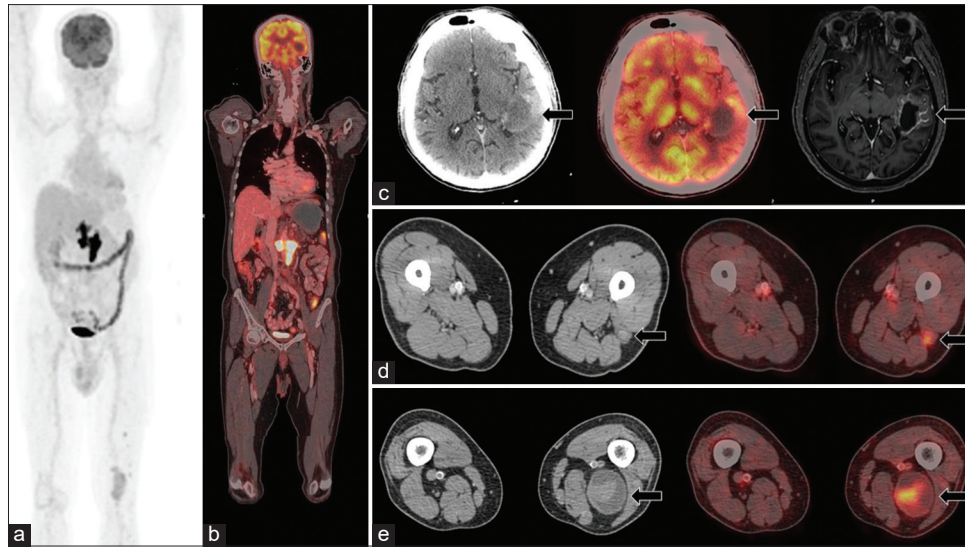
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**Figure 1:** 18F-FDG PET/CT (a) MIP image and (b) fused coronal image showing retroperitoneal nodal disease and intermuscular deposit in the left popliteal region. CT, Fused PET/CT and MRI (T1-weighted postcontrast) images showing (c) metastatic cystic brain lesion in the left temporal lobe with fluorodeoxyglucose avidity and enhancement along its periphery (arrow) (d) and (e) and fluorodeoxyglucose avid intermuscular deposits in the posterior compartment of the left thigh (arrow)

been reported in around 1%–8% urinary bladder cancer patients, usually during chemotherapy.<sup>[7]</sup> Neurological symptoms usually precede the detection of cerebral metastasis. Brain is a sanctuary site for chemotherapy as frequently used drug regimens cannot penetrate blood–brain barrier. Owing to this effect, it is possible that microscopic tumors cells may invade brain parenchyma early and stay dormant with activation at a later time, eventually forming macroscopic tumors.<sup>[8]</sup> MRI is known to be most sensitive for the evaluation of brain and muscular lesions. FDG PET-CT scan is a useful noninvasive modality for the detection of nodal and distant metastasis in urinary bladder cancer, that combines both metabolic and anatomical imaging features, along with the added benefit of a whole-body imaging thereby helping in the assessment of metastatic disease burden including rare sites such as brain and skeletal musculature in a single examination.

#### 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 identity, but anonymity cannot be guaranteed.

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#### Conflicts of interest

There are no conflicts of interest.

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