

Huge Tumor Thrombus of Chondrosarcoma on FDG PET/CT

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Abstract: A 24-year-old woman presented with progressive pain in the left groin and left buttock for 4 months. The whole-body FDG PET/CT and MRI of the pelvis revealed a left pelvic mass and venous thrombosis in the left common iliac vein, inferior vena cava, and right atrium. Chondrosarcoma with venous tumor invasion of the inferior vena cava to the right atrium was documented surgically.

Key Words: chondrosarcoma, tumor thrombus, FDG PET/CT, MRI

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FIGURE 1. A 24-year-old woman presented with progressive pain in the left groin and left buttock for 4 months. There was also swelling of the left lower extremity. Rather, the pulsation and perfusion of the left lower extremity seemed intact and there was no sign of pitting edema or lymphedema. The contrast-enhanced CT with multiplanar reconstruction disclosed an ill-defined mass in left pelvic cavity (arrowheads). The pelvic mass seemed closely contacting with the left pelvic bones, revealing inside calcification, causing periosteal reaction and being enhanced after intravenous administration of contrast medium. The CT features of the mass were thought to be a cartilage malignancy. Surprisingly, the CT also showed the dilated left common iliac vein and inferior vena cava. In addition, it seemed that a long segmental intravenous filling defect extended from the left pelvic mass to the right atrium and revealed inside punctate calcification and heterogeneous enhancement (asterisks). A huge tumor thrombus was suspected on the basis of the above findings.

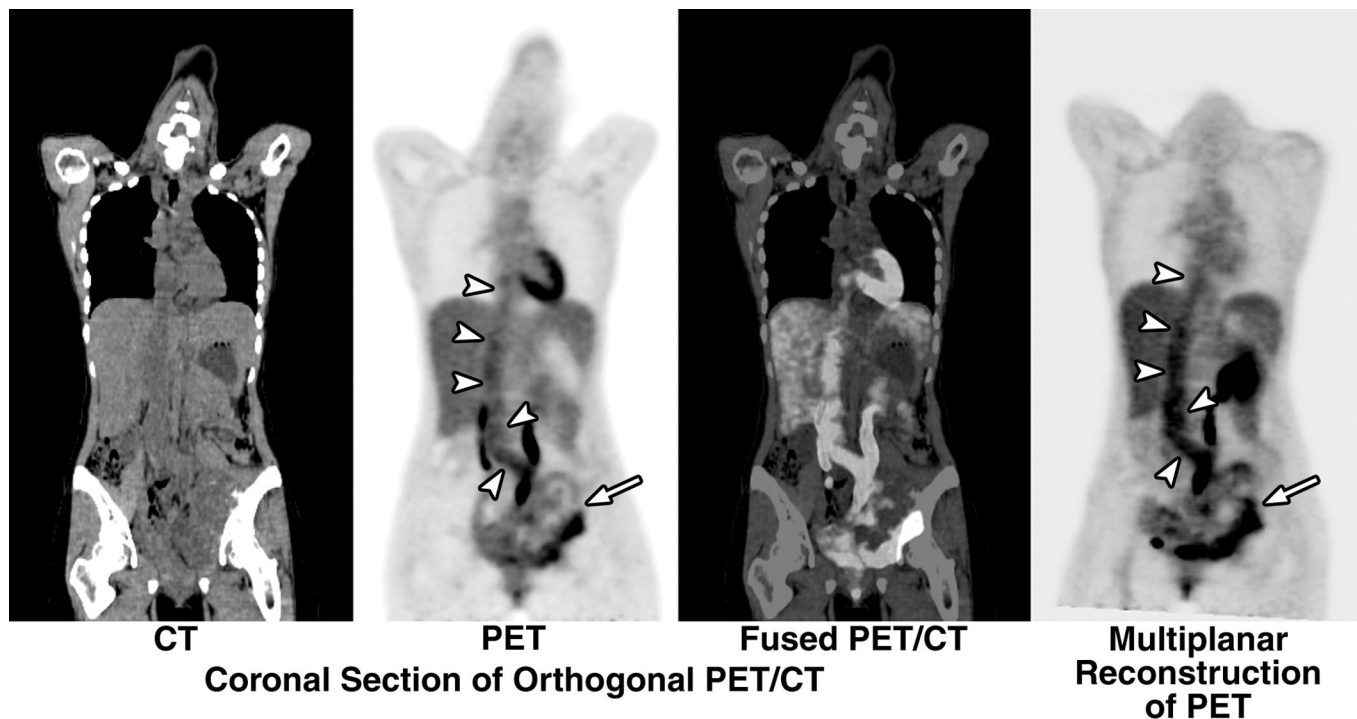


FIGURE 2. The FDG PET/CT showed heterogeneous distribution of abnormally increased FDG radioactivity (maximum SUV = 4.1) in the left pelvic cavity (arrows), corresponding to the pelvic mass disclosed on the contrast-enhanced CT. Nevertheless, there also seemed to be slightly increased FDG radioactivity (maximum SUV = 3.0), in contrast to the blood-pool background radioactivity, along the left common iliac vein, inferior vena cava, and the right atrium of heart (arrowheads).

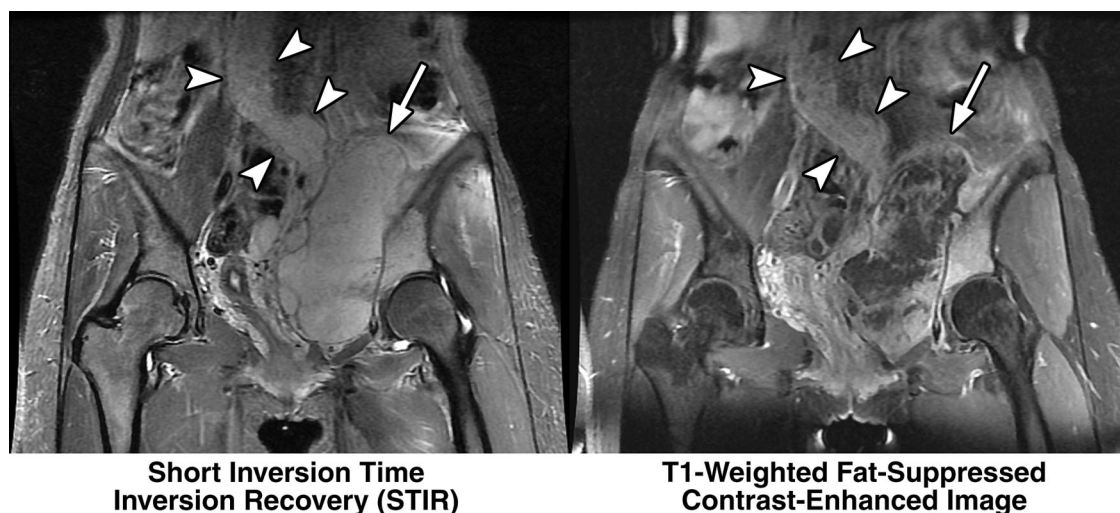


FIGURE 3. The MRI of the pelvis revealed hyperintensity on the short-inversion-time inversion recovery (STIR) images and heterogeneous enhancement on the T1-weighted fat-suppressed contrast-enhanced images in both, pelvic (arrows) and intravenous lesions (arrowheads). The earlier MRI features, in accordant with the CT and FDG PET/CT findings, strongly suggested the highly probable malignant nature of the pelvic mass. On the other hand, the same MRI features, despite the equivocal CT and PET/CT findings, supported the diagnosis of tumor thrombus along the left common iliac vein, inferior vena cava, and the right atrium.

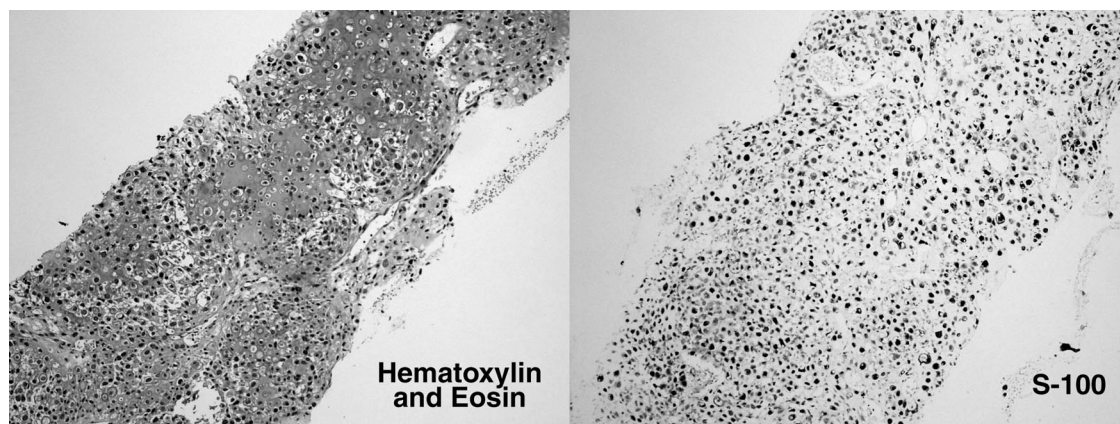


FIGURE 4. CT-guided biopsy of the pelvic tumor revealed hyaline cartilages and chondrocytes with hypercellularity as well as marked cellular pleomorphism and hyperchromasia (hematoxylin and eosin stain, 100 \times). The immunohistochemical study showed positive for S-100 stain (100 \times). Grade 2 chondrosarcoma was diagnosed according to the radiologic and pathologic findings. After the multidisciplinary team discussion about the treatment strategy, neoadjuvant chemoradiation therapy followed by cytoreduction surgery was suggested because of the advanced stage of disease and clinical suspicion of occult tumor thrombi elsewhere. However, this patient hesitated for suggested treatment and lost follow-up after her insistence of hospital discharge for alternative therapy.

Venous thrombosis is a multifactorial disorder. Compared with the general population, there are several folds of increasing incidence and progression of venous thrombosis in patients with cancer.¹ The pathogenesis of thrombotic disorders in patients with cancer includes hypercoagulability, venous stasis, and vessel wall damage.² Tumor thrombosis is a relatively rare complication of solid cancers and the reported incidence of occult inferior vena cava tumor thrombosis is about 0.11%.³ Tumor thrombosis diagnosed by FDG PET has been reported sporadically in various types of cancer, including renal cell carcinoma,^{4–6} pancreatic cancer,⁷ colon cancer,⁸ adrenocortical carcinoma,⁷ thyroid cancer,^{9,10} osteosarcoma,^{11,12} Ewing sarcoma,³ leiomyosarcoma,¹³ gallbladder cancer,¹⁴ hepatocellular carcinoma,^{3,15,16} and lymphoma.^{3,16} Typically, tumor thrombosis presents with high FDG uptake. However, the infectious or bland thrombosis may also appear with increased FDG radioactivity,^{17,18} causing difficulties in correct diagnosis based on FDG PET only.

Contrast-enhanced CT may be useful in detecting venous thrombosis but greatly depends on an adequate bolus of contrast with faster injection rate for optimal vessel opacification.² However, the routine contrast-enhanced CT is usually done with a slower injection rate of contrast because the most majority of venous thromboses, usually unsuspected, in patients with cancers is found incidentally. Therefore, the abilities to detect and characterize the venous thrombosis with routine contrast-enhanced CT are usually compromised. On the other hand, MRI is helpful in differentiating the bland and tumor thrombus. Several characters can be used to distinguish the tumor thrombus from the bland one, such as gross direct invasion of tumor parenchyma into the adjacent veins, abnormal contrast enhancement within the thrombus, and irregular venous lumen expansion.²

Chondrosarcoma is a malignant tumor with cells that produce cartilage matrix. Primary chondrosarcoma is the third most common primary malignant tumor of bone, constituting 20% to 27% of all primary malignant osseous neoplasms.¹⁹ It predominantly affects middle-aged individuals with a predilection for the proximal femur and pelvis.²⁰ Radiographic findings often suggest the diagnosis of chondrosarcoma because of identification of typical “ring-and-arc” chondroid matrix mineralization on the plain radiograph and CT and aggressive features of deep endosteal scalloping and soft-tissue extension on the plain radiograph and MRI.¹⁹

The histologic features of chondrosarcoma reveal abundant hyaline cartilage stroma with chondrocytes residing in lacunar spaces. The chondrocyte may have a relatively inconspicuous cytoplasm but a various-sized nucleus. The increasing deviation from the appearance of normal hyaline cartilage represents the increasing dedifferentiation of chondrosarcoma and is characterized as increasing overall cellular density, increasing nuclear size, increasing nuclear pleomorphism, presence of bi- and multinucleate chondrocytes, and changes in the density of the extracellular chondroid matrix.²⁰

Several reports have mentioned about the utility of FDG PET in assessment of chondrosarcoma.^{21–26} Many of these reports have found that there is a wide range of FDG uptake of the chondrosarcoma.^{21–23} In addition, they have also found that the pathologic grade and prognosis of these tumors are relevant to the degree of FDG uptake. Chondrosarcomas with higher SUV tend to have higher pathologic grade and poorer prognosis.^{21–23,26}

Surgical resection remains the primary and preferred treatment for localized chondrosarcoma. Radiation therapy may play an adjunct role in the treatment of positive surgical margins or palliation of disease-related symptoms. However, the treatment for advanced, metastatic disease is still challenging because the conventional chemotherapy has been proven to be ineffective in most circumstances, but may be considered in variant forms such as mesenchymal or dedifferentiated chondrosarcomas.²⁰

Our case presents a unique picture of chondrosarcoma with huge tumor thrombosis. The whole-body scanning character of FDG PET/CT provides the initial thorough view of disease extent. On the other hand, the MRI reinforces evidences indicating the malignant nature of these lesions. To the best of our knowledge, the current case is the first reported tumor thrombosis of chondrosarcoma demonstrated on the FDG PET/CT.