Hepatic Radiation Injury Mimicking a Metastasis on Positron-Emission Tomography/Computed Tomography in a Patient with Esophageal Carcinoma

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A 61-year-old man with locally advanced (T3 N1 M0) esophageal adenocarcinoma involving the distal esophagus and gastric cardia was initially treated with four cycles of epirubicin, oxaliplatin, and capecitabine and three cycles of docetaxel and irinotecan. He was then treated with concurrent chemoradiation consisting of 5-fluorouracil, docetaxel, and 50.4 Gy of intensity-modulated radiation therapy to the primary malignancy and locoregional nodes. A positron-emission tomography/computed tomography (PET/CT) scan with fluorodeoxyglucose (FDG) performed 5 weeks after completion of radiation therapy showed a decrease in the size and intensity of the primary neoplasm in the distal esophagus and resolution of tracer uptake in locoregional paraesophageal and left gastric lymph node metastases that were present on a pretreatment PET/CT scan. However, there was a new ill-defined nodular area of hypermetabolism (SUV_{max} = 7.0) in the left lobe of the liver, measuring approximately 3.5 cm in diameter (Figures 1 and 2). Contrast-enhanced CT of the abdomen showed that the increased FDG uptake corresponded to a poorly marginated region of mixed attenuation and heterogeneous enhancement in the lateral segment of the left lobe of the liver (Figure 3).

CT-guided liver biopsy of this region was performed, with fine needle aspiration cytology that showed reactive hepatocytes but no malignant cells. Review of the radiation dosimetric intensity-modulated radiation therapy treatment curves showed that the FDG-avid hepatic lesion corresponded to an area of radiation dose of 40 to 45 Gy (Figure 4). Because the liver is susceptible to radiation injury at a dose above 30 Gy, the abnormality was presumed to be due to radiation-induced injury. An intraoperative liver wedge biopsy obtained immediately before planned Ivor-Lewis esophagectomy confirmed the absence of metastatic disease

FIGURE 1. Initial staging coronal whole body positron-emission tomography (PET) showed the primary tumor in the distal esophagus (SUV_{max} of 6.6) and adjacent left gastric lymph nodes (SUV_{max} of 4.4). There were no liver metastases. SUV, standard uptake value.

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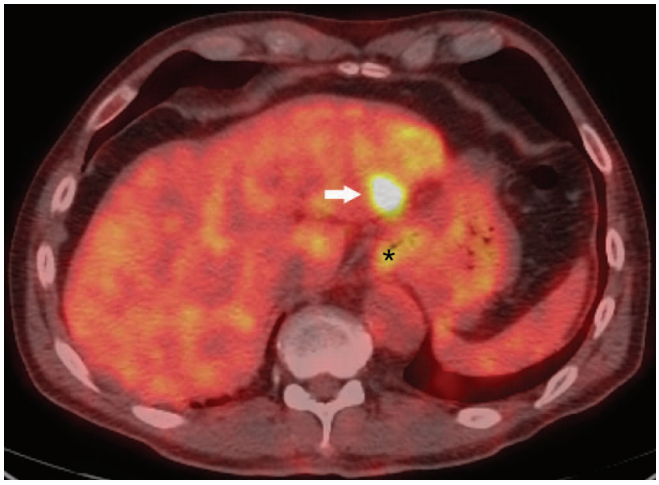

FIGURE 2. Five weeks after completion of radiation therapy, axial fused positron-emission tomography/computed tomography (PET/CT) showed the primary tumor at the gastroesophageal junction (asterisk) and a focus of fluorodeoxyglucose (FDG) uptake in the left hepatic lobe (arrow) with SUV_{max} of 7.0 suspicious for metastasis.

FIGURE 3. Axial contrast-enhanced computed tomography (CT) of the abdomen showed a poorly marginated region of mixed-attenuation and heterogeneous enhancement in the lateral segment of the left lobe of the liver measuring 3.5 cm corresponding to the focus of increased fluorodeoxyglucose (FDG) uptake on positron emission tomography (PET) suspicious for metastasis (arrows).

and showed marked sinusoidal dilatation and congestion, mild portal fibrosis, and mild chronic inflammation consistent with radiation-induced hepatic injury. The patient proceeded to have Ivor-Lewis esophagectomy and mediastinal and abdominal lymph node dissection.

DISCUSSION

Multimodality treatment with chemotherapy, radiation, and surgical resection is increasingly being used in patients with locally advanced esophageal cancer.[1,2] The appropriate selection

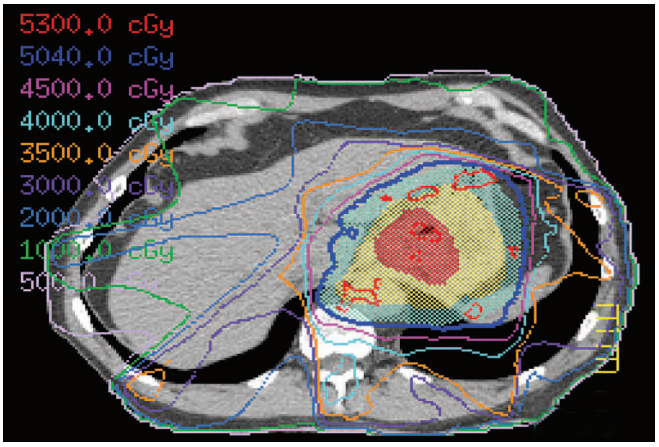

FIGURE 4. Axial noncontrast-enhanced computed tomography (CT) of the abdomen with radiation dosimetric intensity-modulated radiation therapy (IMRT) treatment curves showed that the fluorodeoxyglucose (FDG)-avid hepatic lesion corresponded to an area of radiation dose of 40 to 45 Gy.

of patients who undergo preoperative chemoradiation therapy (CRT) followed by surgical resection is important as this therapy is associated with significant morbidity. In this regard, reassessment by CT after CRT often does not correlate with pathologic response. The functional information provided by FDG-PET/CT can provide additive information with regard to locoregional response and aiding in the detection of occult metastases.[3,4] One of the causes of false-positive PET scanning is uptake in the liver adjacent to a distal esophageal cancer after CRT because of radiation-induced injury. This new case has PET/CT findings similar to those reported in a recent series of 26 patients with esophageal cancer treated with CRT.[5] In that series, two patients (7.5%) developed FDG-avid radiation-induced injury in the left lobe of the liver 6 weeks after completion of therapy, whereas 15 had attenuation and contrast abnormalities detected on CT.[5] The activity on PET in these cases is most likely due to tracer uptake in active leukocytes forming the inflammatory response to the radiation-induced hepatic injury. The imaging appearance of hepatic radiation injury in patients with esophageal cancer on PET/CT can vary from focal to diffuse increased FDG uptake and can be misinterpreted as hepatic metastatic disease.[5]

In summary, therapeutic doses of radiation to the liver after CRT can result in metabolic changes in the liver in patients with distal esophageal cancer. Although often diffuse in nature, this uptake can be focal and nodular and could be mistaken for metastatic disease. Awareness of the occurrence of radiation-induced hepatic injury and knowledge of the typical location and appearance on PET/CT imaging in patients with distal esophageal malignancy receiving CRT can be useful in suggesting the diagnosis and in preventing misinterpretation.

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