Positron emission tomography–computed tomography of esophageal adenocarcinoma with vascular invasion and tumor thrombus

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Esophageal adenocarcinoma is a common malignancy affecting more than 16,000 patients in 2010 (1). We report a rare case of esophageal adenocarcinoma with vascular invasion and tumor thrombus extending from the esophageal mass into the azygos vein, as shown on positron emission tomography–computed tomography (PET-CT), which to our knowledge has not been previously reported.

CASE REPORT

A 66-year-old man with a several-month history of dysphagia and weight loss presented to a gastroenterologist and underwent upper endoscopy and biopsy. This revealed a moderately differentiated invasive adenocarcinoma in the distal third of the esophagus. He was then referred for PET-CT, which was performed 60 minutes after the injection of 540.2 MBq F-18 flourodeoxyglucose (FDG).

PET-CT images demonstrated a hypermetabolic soft tissue mass in the distal third of the esophagus with a maximum standardized uptake value of 16.1, compatible with a known primary malignancy. A linear focus of hypermetabolism was seen coursing posterior and to the right of the esophageal mass and anterior to a thoracic vertebral body (*Figure 1*). This is consistent with tumor thrombus extending into the proximal azygos vein.

A hypermetabolic focus was also present in the right atrium. There was no hypermetabolism in the interposed cardiac wall to suggest direct invasion from the large esophageal mass (*Figure 2*). Findings represented tumor thrombus extension into the right atrium from the extensive tumor thrombus in the azygos system.

This examination also showed local and distant metastatic disease, including pulmonary metastasis and pulmonary tumor emboli. Discrete hypermetabolic nodules were seen in the right lower lobe as well as the lingula (*Figure 3*). The lingular hypermetabolic nodule had a well-rounded configuration, more compatible with a metastatic pulmonary nodule (2). The right lower lobe lesion was centrally located and corresponded to a segmental lower lobe pulmonary artery, compatible with a metastatic pulmonary embolus from the tumor thrombus that was shown in the right atrium (3).

DISCUSSION

Many articles have been published discussing tumor thrombus. However, despite an estimated 16,640 new cases of esopha-

geal carcinoma diagnosed in 2010, with approximately 14,500 deaths (1), no cases of esophageal adenocarcinoma with vascular invasion and tumor thrombus have been previously reported.

Previously, squamous cell carcinoma was the most common cancer cell type to affect the esophagus in the United States. Recently, these statistics have changed, and adenocarcinoma is responsible for over 50% of esophageal cancers (1). The development of adenocarcinoma is due to squamous metaplasia from Barrett esophagus and development of glandular cells in the distal esophagus, which normally line the adjacent stomach (1).

Figure 1. Sagittal localization CT, PET, and fusion PET-CT images demonstrate a curvilinear focus of FDG hypermetabolism that corresponds to the extension of the tumor into the azygos vein as it courses posterior to the right main stem bronchus, turns into the azygos arch, and joins the superior vena cava.

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Figure 2. Transaxial localization CT, PET, and fusion images through the midchest demonstrate a hypermetabolic tumor just anterior to a midthoracic vertebral body. This corresponds to the location of the azygos vein. There are also two distinct foci in the lungs. The right-sided focus corresponds to a right lower lobe segmental pulmonary artery on localization image, compatible with a pulmonary tumor embolus. The hypermetabolic pulmonary nodule in the left upper lobe is subpleural in location and compatible with a metastatic pulmonary nodule.

Figure 3. Transaxial localization CT, PET, and fusion images through the lower chest show a large rounded hypermetabolic focus just anterior to a lower thoracic vertebral body. This is the patient's known primary esophageal adenocarcinoma. Just anterior to the primary malignancy is another smaller rounded focus of tracer hypermetabolism, which is within the right atrium. This is compatible with tumor extension from the azygos system into the right atrium, as there is no FDG hypermetabolism in the interposed soft tissue to suggest direct invasion.

Early detection of esophageal adenocarcinoma with subsequent esophagectomy can be curative in many early stage presentations, but most patients present with locally advanced disease (4). Up to 20% to 30% of patients present with distant metastasis (5), as seen in our case, which had both local invasion and pulmonary metastatic disease. The most common sites of visceral metastatic disease from esophageal carcinoma are the lungs, liver, bones, and adrenal glands (6).

The PET-CT images shown in this case were obtained in standard fashion, including both multiplanar reformatted PET images and low-dose nonintravenous contrast-enhanced CT localization images from just below the skull vertex through the midhighs. The addition of CT images to the PET images allows for more accurate localization of metabolically active findings, with minimal added radiation to the patient. PET-CT has known utility in patients with esophageal carcinoma, both for initial staging and for assessment of treatment response (6).

The diagnosis of vascular thrombus can be made by multiple different imaging modalities. A unique feature of PET-CT demonstrated in this case is the ability to allow the reader to discern metabolically active lesions from nonmetabolically active ones, such as tumor thrombus versus bland thrombus.

This feature is a direct reflection of the tumor thrombus's F-18 FDG avidity (7). The ability to distinguish bland thrombus from tumor thrombus can be important in determining subsequent treatment planning, as the treatment regimens for the two diagnoses vary greatly.

In summary, PET-CT continues to prove useful clinically in the staging and subsequent treatment response of many malignancies. We present a unique case of a staging PET-CT that showed an unsuspected metastatic pattern involving gross vascular invasion from esophageal carcinoma.

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Reader comments

DEAR DR. ROBERTS:

I loved your section of the July 2011 issue of *Baylor Proceedings*. The information from the *Barron's* article was great. I was ship physician on Sea Cloud 10 times (see www.seacloud.com). I am a retired pediatric surgeon.

—DICK G. ELLIS, MD
Fort Worth, Texas

DEAR DR. ROBERTS:

As usual, I thoroughly enjoyed the July *Baylor University Medical Center Proceedings*. Over my last 17 years in practice, I continue to benefit from its significance and the information that it has with each publication.

In reviewing the journal, I noticed there is no plastic surgeon on the editorial board. Despite our small field, plastic surgery crosses over numerous disciplines such as craniofacial surgery, hand surgery, surgery of the head and neck, breast surgery, orthopedic surgery, and dermatology. In keeping with this need, I want to recommend William Carpenter, MD. Bill has been on the Baylor campus for approximately 20 years. He is well regarded in many aspects of plastic surgery and is well respected in the community. Additionally, I feel that he has a discerning academic perspective and I think that he would be an outstanding asset to your editorial board.

Once again, I congratulate you on the continued success of the journal.

—PATRICK H. POWNELL, MD
Dallas, Texas

DEAR BILL,

Thank you for taking an interest in John [Krause, interview published in April 2011 issue] and writing about his life. He is an exceptional (bias!) person, and you so well captured his equanimity. Our family and I will always cherish your words and reflection about John.

—PAULETTE [KRAUSE]

DEAR DR. ROBERTS:

I read your Facts and ideas article in the July *Proceedings* and enjoyed it very much, particularly the discussion of trees, cholesterol, cesarean sections, and life expectancy. There was a typo in “Marathon Run.” The time is 4:69 minutes per mile, not miles per minute. I was also running 4:42-minute miles in high school, but that was 63 years ago. For whatever it is worth, I completed the Boston Marathon at age 45, running 7-minute miles. Keep up the good work!

—C. A. RUNDELL JR.
Addison, Texas