PET Bytes

News from *The Positron Imaging Facility* at UT Southwestern Medical Center at Dallas

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PET Imaging in Head and Neck Cancer

Head and neck cancers, excluding thyroid cancer, are common cancers and associated with use of tobacco and alcohol. Most are squamous cell cancers and are, unfortunately, not detected until advanced stages with lymph node metastases and an unknown primary location. Squamous cell cancers (SCC) usually evidence intense fluorodeoxyglucose (FDG) uptake and may be evident when less than a centimeter in size, the usual criterion for detection in lymph nodes on CT and MR[1]. Adenocarcinomas usually also evidence FDG uptake, although sometimes not as intensely as SCC.

PET/CT has proven useful in identification of unknown primary sites, as well as staging of lymph node status in patients with a known primary (Fig 1). PET/CT is also useful in evaluating response to therapy and in restaging patients in whom recurrence is suspected. Following surgery and radiation, normal tissue planes may substantially altered, making evaluation with CT and MR less specific. Since FDG PET shows areas of increased tumor metabolism, detection in the altered tissues is more specific. The intensity of FDG uptake has also been found to be a predictor of tumor aggressiveness [2].

In comparison to PET alone, PET/CT has been particularly useful in evaluation of these tumors as the anatomic details are enhanced with the CT fusion. There are many sites of increased FDG uptake of a physiologic nature in the head and neck, including lymphoid tissue, salivary glands, tense neck muscles and metabolically active fat. These could potentially be misinterpreted on PET alone as false positives (Fig 2).

Medicare presently reimburses PET/CT for tumor diagnosis, staging and restaging. At present, Medicare does not approve PET imaging for medullary thyroid cancer and PET imaging in papillary thyroid cancer is limited to only those cancers that are no longer avid for iodine.

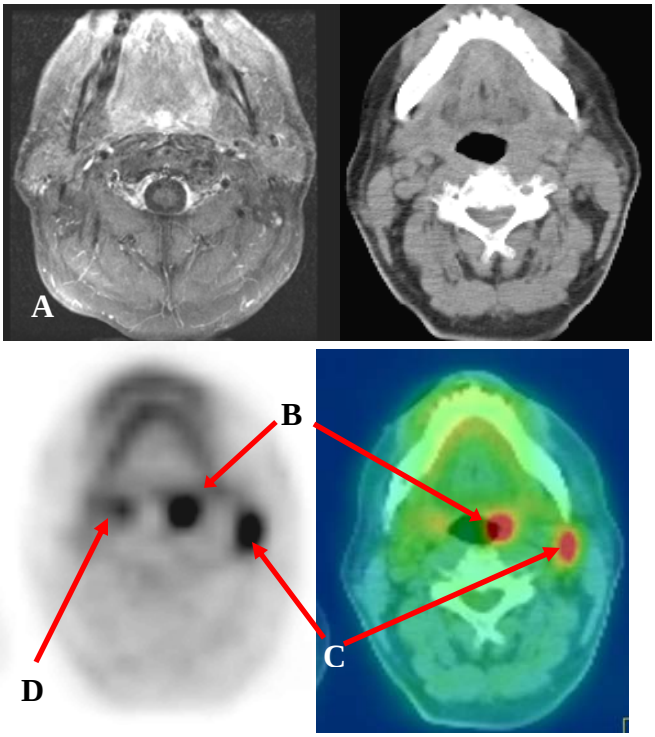

Figure 1: The patient was a middle-aged man who presented with left lymph node metastasis. An MRI shows fullness at left tongue base (**A**), without clear primary tumor and two *level 2* lymph nodes. The PET/CT clearly demonstrates primary tumor at left tongue base (**B**) as well as ipsilateral lymph node metastasis (**C**). The focal uptake in the right tongue base is normal (**D**).

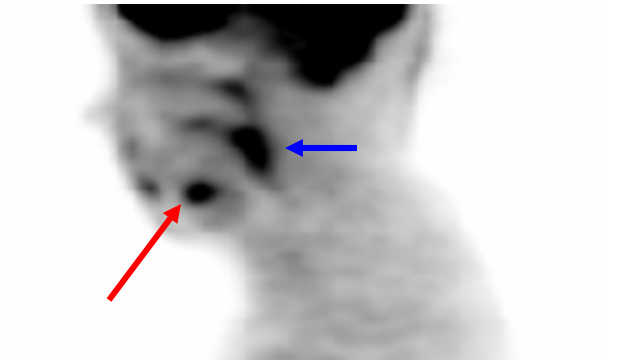

Figure 2: FDG PET shows normal physiologic uptake in lymphoid structures such as tonsils (**blue arrow**) and in salivary glands (**red arrow**).

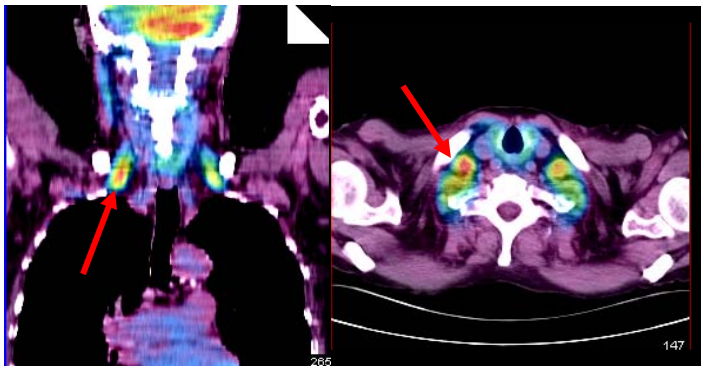

Figure 3: Fused PET showing FDG uptake in scaleneus muscles (red arrows).

References:

1. Wong WL, Chevretton EB, MCGurk M, et al. A prospective study of PET-FDG imaging for the assessment of head and neck squamous cell carcinoma. Clin Otolaryngol. 1997; 22: 209-214.
2. Schwartz DL, Rajendran J, Yueh B, et al. FDG-PET prediction of head and neck squamous cell cancer outcomes. Arch Otolaryngol Head Surg 2004;130: 1361-1367.

Use of Valium in PET Imaging of the Head and Neck Cancer Patient

You may have wondered why we request oral valium for patients undergoing PET imaging for cancers of the head and neck. Surprisingly, it is not for treatment of anxiety. If patients have muscle tension during the uptake phase of FDG, it can result in increased accumulation of FDG in the neck muscles. In addition, if patients are cold during the uptake phase, metabolically active fat in the neck and upper chest can show accumulation of FDG. Valium reduces FDG uptake in both of the circumstances. This allows clearer interpretation of the scan.

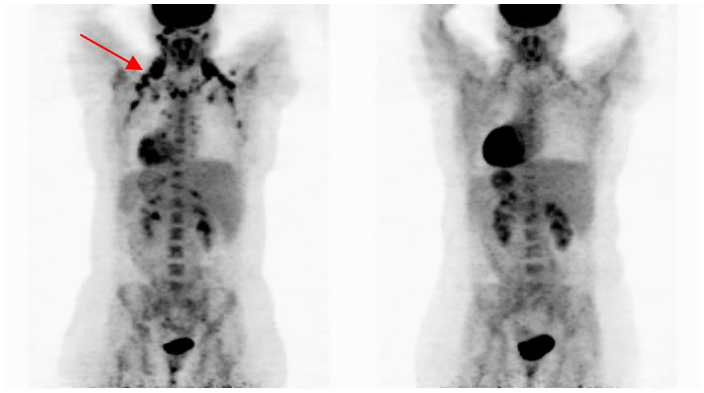

Figure 4: PET scans showing uptake in cervical, supraclavicular and axillary fat in a patient who was cold and shivering(left). The patient was brought back four days later and kept warm during the uptake phase . Images (right) show reduction in uptake. Valium also reduces the metabolic activity in fat, thereby reducing uptake.

References:

1. Silverman DHS and Phelps ME. Evaluating dementia using PET: how do we put into clinical perspective what we know to date? JNM (2000) 41: 1929-1932.
2. Becherer A, et al. Brain tumour imaging with PET: a comparison between [^{18}F] fluorodopa and [^{11}C] methionine. Eur J Nucl Med Mol Imaging (2003) 30: 1561-1567.

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