Combined PET/CT Imaging of Recurrent Skull Base Neoplasm

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Purpose
Distinguishing recurrent neoplasm from posttreatment effect may be extremely difficult in the skull base. [F-18] fluorodeoxyglucose (FDG) PET has proved superior to either CT or MR imaging in detecting recurrence and distinguishing tumor from postirradiation effects and scar in extracranial head and neck cancer. PET alone suffers from limited anatomical localization and spatial resolution, particularly important in the skull base, where exquisite localization of small anatomical structures is crucial in planning treatment. A combined modality, the PET/CT tomograph, permits acquisition of anatomical (CT) and metabolic (FDG-PET) data during the same imaging session. We present preliminary experience with the prototype PET/CT in the evaluation of recurrent skull base neoplasm.

Materials & Methods
We have performed over 30 combined FDG PET/CT studies for a variety of head and neck oncologic indications since July 1998. Of these, four patients (3 women, 1 man; age range: 23 to 73 years) underwent FDG PET/CT scanning for suspected recurrent cranial base neoplasm. Primary neoplasms included: ethmoid sinus squamous cell carcinoma (SCCA), temporal bone basal cell carcinoma, buccal SCCA, and external auditory canal SCCA. PET and CT imaging was performed on the prototype combined CTI/Siemens PET/CT scanner which comprises an ECAT ART PET scanner and a Somatom AR.SP CT scanner. The PET/CT was performed approximately 1 hour following a 6–7 mCi iv injection of FDG, with acquisition of helical CT data (pitch 1.6) immediately preceding acquisition of 3D emission data (10 min per bed position; 2–3 bed positions/subject) covering the skull base, neck, and upper thorax. The CT was performed with dynamic injection of iv contrast (90 cc Optiray-320). The PET images are corrected for attenuation using coefficients obtained by scaling the CT numbers from the CT images to the PET energy (511 keV) (1). The helical CT scan was reconstructed into 512 x 512 images with a slice thickness of 3.4 mm to match that of the PET scan. The PET/CT data were analyzed using two methods: 1) qualitative (visual analysis) and 2) quantitative (standardized uptake value, SUV). The SUV represents the normalization of radioactivity to injected dose, adjusted for body weight. Images were interpreted by two neuroradiologists. Focally elevated FDG uptake was considered subjective evidence for neoplasm. FDG uptake with a SUV > 3.0 was the threshold for objective evidence of neoplasm, whereas a SUV of 2.0 to 3.0 was considered equivocal for neoplasm.

Results
Three of four of the patients had foci of increased FDG uptake (SUV ≥ 3.0) in the region of clinically suspected neoplasm; 2/3 were histologically proved. In one case with histologically
proved invasion of V2, PET/CT did not demonstrate perineural invasion seen on MR imaging, but showed unsuspected recurrence in the right masticator space.

**Conclusion**
Combined FDG PET/CT mitigates the relatively low spatial resolution of PET alone to provide anatomical localization of metabolically active neoplasm in the skull base. Differentiation of recurrent neoplasm from posttreatment effect with combined PET/CT may avoid treatment delays as a result of relying on serial imaging to detect tumor recurrence. The combined PET/CT may prove a useful technique for detecting recurrent skull base neoplasms and planning treatment.

**References**

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