Head and Neck Cancer Case Study

Clinical History

A 67 year old woman presented for evaluation after experiencing several months of pain in the face and jaw. She underwent a CT scan which revealed an extensive mass in right maxillary sinus, eroding through the palate, orbital floor, and pterygoid plates and extending into the lateral nasal wall. A CT guided biopsy revealed a poorly differentiated squamous cell carcinoma. She was offered reconstructive surgery. The patient requested a second opinion and the surgeon referred her for an ^{18}F FDG PET•CT scan for initial staging.

Imaging Findings

Examination Protocol

NUCLEAR MEDICINE PET•CT Scan: 9/20/2007
STATED REASON FOR REQUEST: Staging head and neck cancer
RADIOPHARMACEUTICAL ADMINISTERED: 10 mCi ^{18}F FDG IV.
TECHNIQUE: Routine head and neck protocol post-contrast PET. CT exam was performed from the top of the head to the proximal thighs, utilizing 120cc of IV Omnipaque-300 for the head and neck portions of the exam only. The exam was performed at approximately 90 minutes delay from IV administration of ^{18}F FDG.

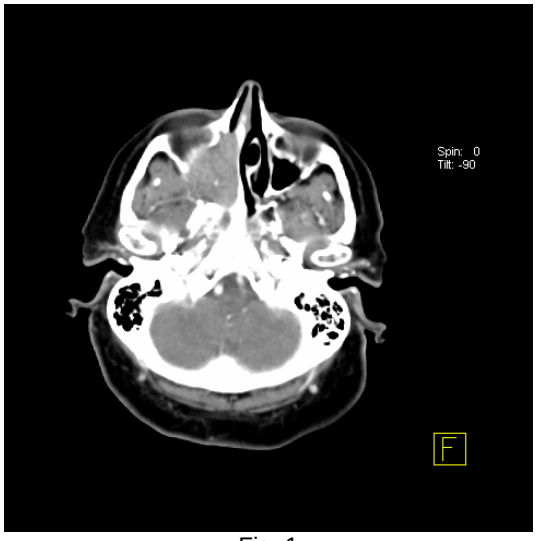


Fig. 1

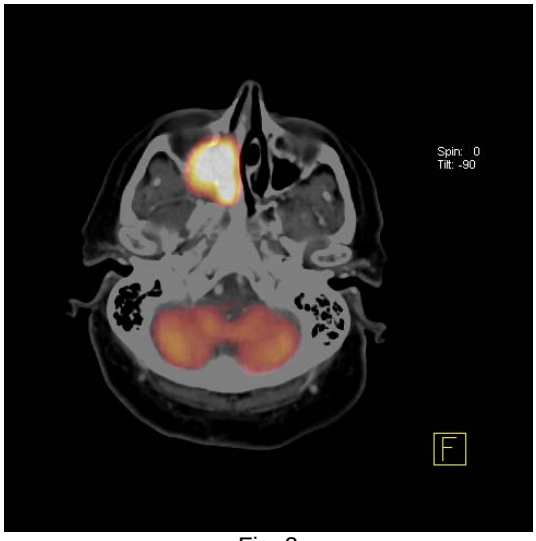
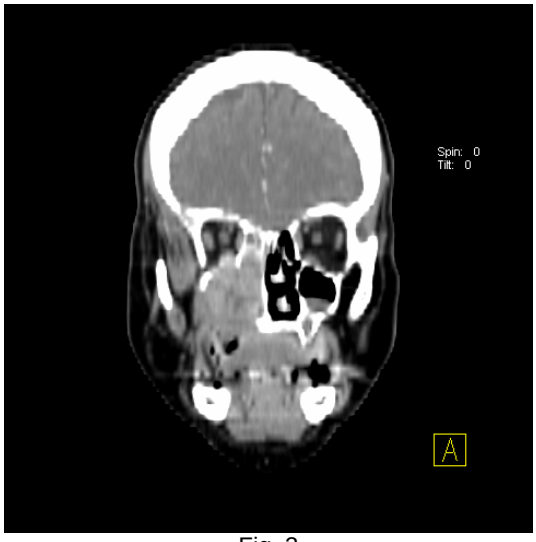


Fig. 2



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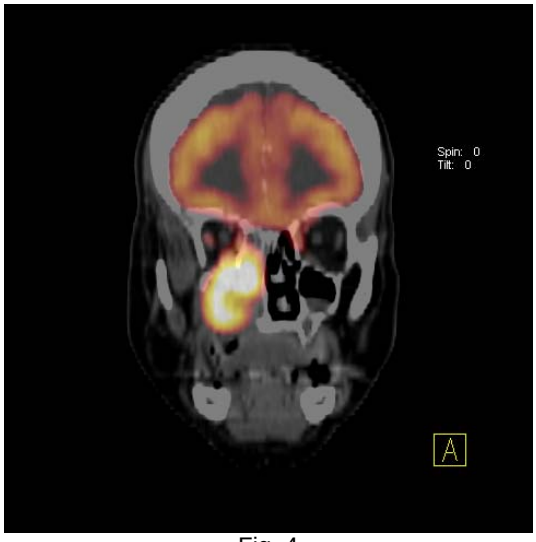


Fig. 4

Imaging Findings

The FDG PET•CT study revealed a large intensely FDG avid mass (SUV 22.8) in the right maxillary sinus with extension superiorly into the anterior ethmoid air cells. Posterior ethmoidal air cells and right sphenoid sinus showed opacification which was probably related to an obstruction rather than tumor extension. The mass extended medially to the nasal septum and posteriorly to the pterygoid plates and pterygoid process. The tumor also extended into the infratemporal fossa involving the posterior pterygoid and temporalis muscles. The pterygoid plate was eroded at the base with extension of the mass into the nasal cavity. The mass extended superiorly to the floor of the orbit without clear evidence of extension into the orbit.

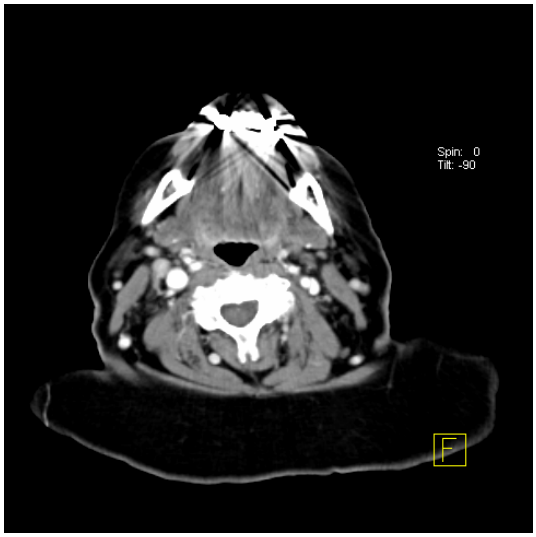
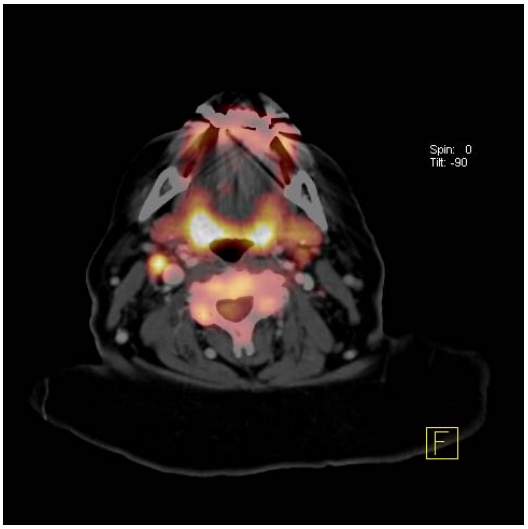


Fig. 5



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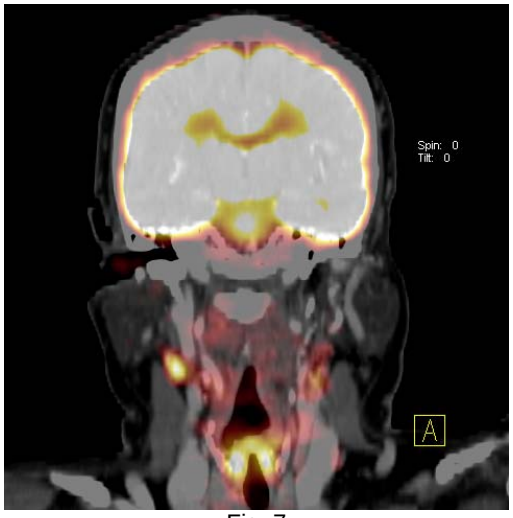

Fig. 7

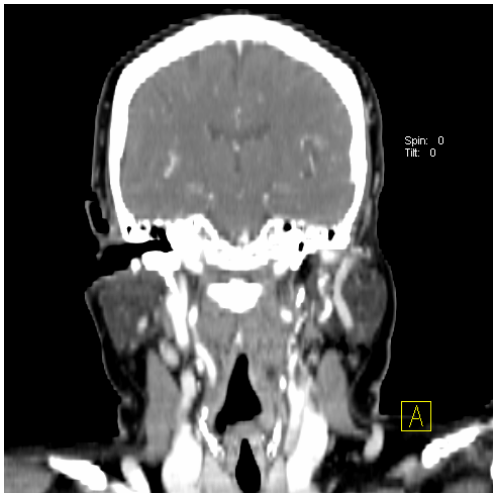

Fig. 8

Inferiorly the mass extended into the left maxillary alveolar ridge and hard palate with bony destruction.

In the neck FDG avid level 2 lymph nodes on the right side were visualized measuring 7 and 5 mm. Level 2 and 3 tracer avid nodes on the left side were also visualized measuring 7 mm. These nodes were consistent with metastases.

In the chest an FDG avid left upper lobe lung nodule was visualized with SUV 3.8 (not shown on images), as well as hilar nodal uptake which may have been related to inflammation. Several small non FDG avid right lung nodules were visualized which appear nonspecific but require CT follow-up.

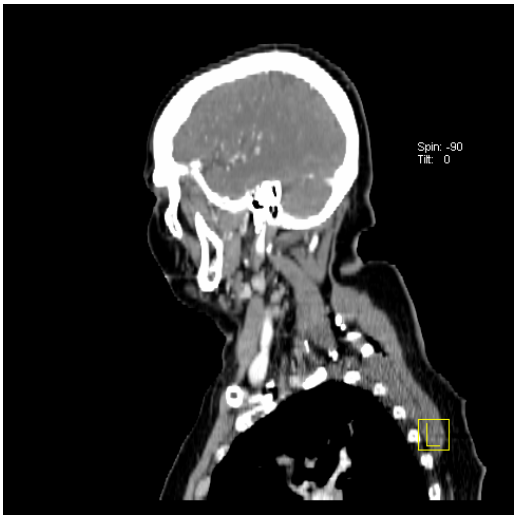

Fig. 9

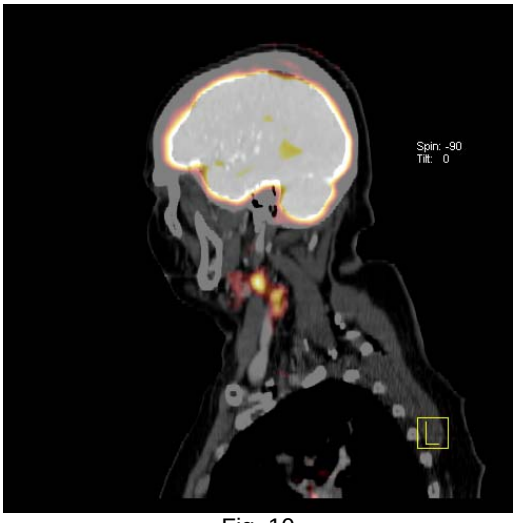

Fig. 10

Fig. 11

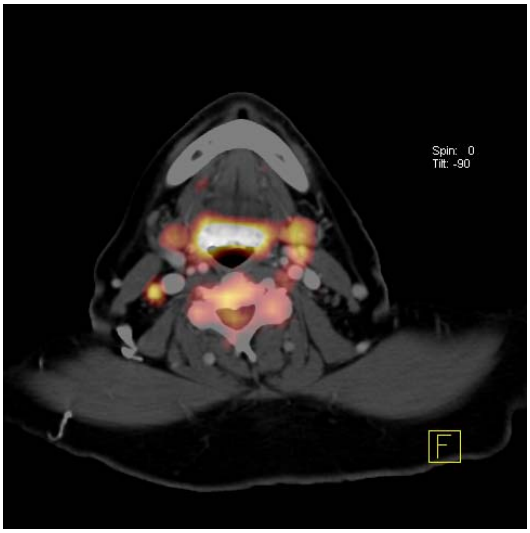

Fig. 12

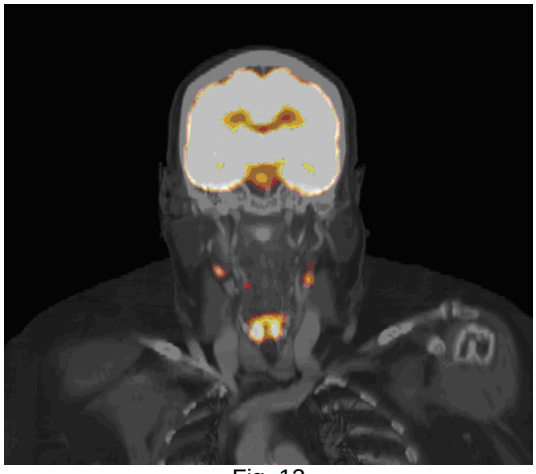
Fig. 13

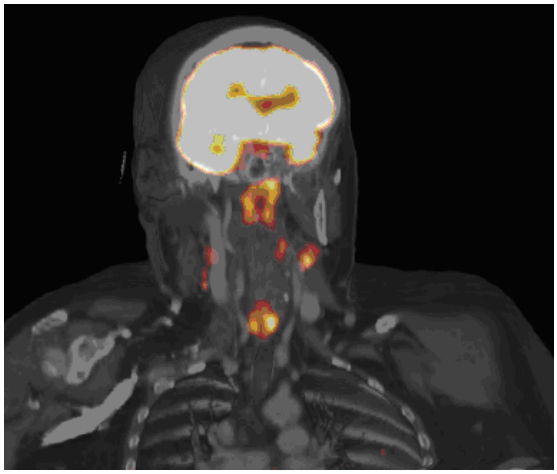
Fig. 14

Diagnosis

The PET•CT findings suggested a large primary nasopharyngeal carcinoma with bilateral neck node metastases.

Treatment

In view of the PET•CT appearance suggesting large primary nasopharyngeal carcinoma with bilateral neck node metastases, the patient was put on chemotherapy with 5-FU, cisplatin and Taxol®.

The patient underwent the first cycle of chemotherapy and was admitted for follow-up and chemotherapy port cellulitis. She underwent a follow-up CT which revealed near complete regression of maxillary sinus tumor. Residual tumor lining the maxillary sinus appeared like thickened mucosa. A fistula between the maxillary sinus and oral cavity was demonstrated which was a result of tumor infiltration and bony erosion.

In view of the apparent response of the tumor to chemotherapy, a follow-up PET•CT was requested. It was important to determine the response of the nodal metastases before a decision was made on the next therapeutic approach. This would probably be a continuation to the next chemotherapy cycle rather than reconstructive surgery.

Discussion

Nasopharyngeal carcinoma (NPC) is rare in the United States but common in southern China and Taiwan as well as Greenland and Alaska. It is predominantly seen in the age group of 30-55 but can also be seen in children. Keratinizing squamous cell carcinoma is the common histology of NPC. The cancer cells show Epstein-Barr virus and viral infection has been linked to this disease. 80% of patients present with neck node metastases. Some may present with nasal obstruction or ear pain due to blockage of the Eustachian tube. With current radiotherapy techniques such as brachytherapy, 3-dimensional conformal radiotherapy, and intensity-modulated radiotherapy in combination with concurrent chemoradiotherapy, a cure can be anticipated for most primary NPC and even for some recurrent disease. Unfortunately, about 5% of patients already have distant metastases at presentation, and up to 30% have distant recurrence after primary definitive radiotherapy[1]. Early diagnosis of neck nodal and distant metastases is crucial to avoid ineffective treatment with curative intent. Several studies have shown PET to be superior to conventional imaging, including CT, for detection of neck lymph node metastases. In one

study involving 18 patients, FDG PET identified 11 metastatic nodes deemed normal by CT in addition to 27 concordant positive and 42 concordant negative results[2].

PET has also been shown to be of value in identification of distant metastases. In one study by Yen et al. 140 patients of NPC deemed free of distant metastases by conventional imaging underwent FDG PET. ^{18}F FDG PET detected 26 true-positive metastatic sites in 18 (12.9%) of the 140 patients, among whom 14 had primary and 4 had recurrent tumors. The patient-based sensitivity and specificity of ^{18}F FDG PET for distant metastases were 100% and 86.9%, respectively. Mediastinal lymph nodes were the most common sites, followed by lung, liver, and bone[1].

PET•CT has been shown to have a higher accuracy compared to PET alone for diagnosis of lymph nodal and distant metastases in NPC. In a study by Chen et al., 86 FDG PET•CT studies were retrospectively performed in 70 patients with NPC. PET only, CT only and PET•CT fused images were evaluated by 3 different interpreters. The results of these images were correlated with histological findings, as well as long-term radiological and clinical follow-up. PET•CT correctly characterized the TNM stage in 82 out of 86 studies. PET alone and CT alone were found to be accurate in 71 out of 86 studies and 63 out of 86 studies, respectively. Furthermore, the differences between PET•CT and either PET alone or CT alone were statistically significant ($p<0.05$). The sensitivity and specificity of FDG PET•CT studies for staging NPC were 96% and 94.4% respectively[3].

In the present study, PET•CT significantly changed the management of the patient by identifying bilateral FDG positive neck node metastases which were not clearly defined on the initial CT scan. The patient was initially offered surgery before the PET•CT scan, but the management approach was changed to chemotherapy after PET•CT demonstrated neck node metastases. Further management decisions will also depend on the follow-up PET•CT scan which is expected to show significant regression, based on the fact that the follow-up CT demonstrated significant regression of the maxillary sinus mass.

Data courtesy of Dr. David Townsend, University of Tennessee Medical Center, Knoxville, Tennessee

References:

1. Value of FDG PET in detection of stage M0 carcinoma of Nasopharynx – Yen et al – JNM 2005;46(3): 405-410
2. Comparison of F18 FDG PET and CT in detection of cervical lymph node metastases of nasopharyngeal carcinoma – Ann Otol Rhinol Laryngol Dec 2000
3. Clinical usefulness of fused PET/CT compared with PET alone or CT alone in nasopharyngeal carcinoma patients – Chen et al – Anticancer Res March 2006