

# **$^{18}\text{F}$ -FDG PET/CT in the Diagnosis of Tumor Thrombus from Anaplastic Thyroid Carcinoma in a Young Boy**

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## **ABSTRACT**

Anaplastic thyroid carcinoma is an uncommon, highly aggressive malignancy usually presenting in the elderly. An eighteen year old boy was recently diagnosed as anaplastic carcinoma of the thyroid. PET/CECT scan performed for staging, revealed a large FDG avid heterogeneously enhancing thyroid mass with bilateral jugular venous thrombosis, which also showed increased FDG uptake, thus pointing towards tumor thrombus. To our knowledge, this is the first case wherein the PET/CT diagnosis of tumor thrombosis from anaplastic thyroid carcinoma was made in a young patient.

**Keywords:** Anaplastic thyroid carcinoma, PET/CT, Tumor thrombosis

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## INTRODUCTION

Anaplastic thyroid carcinoma is rare but one of the most aggressive human cancers and is characteristically diagnosed in patients older than 60 years (1). However, it has been documented in the young, albeit infrequently. A rapid and thorough investigation followed by a multimodality therapeutic approach has been documented to improve the overall survival, especially in the young (1, 2). Intravascular invasion of thyroid cancer is not a frequently encountered finding, although microscopic invasion has been observed particularly in the follicular and poorly differentiated histological types (3). However massive invasion of tumour into the great veins is rare. There are only limited reports describing the usefulness of  $^{18}\text{F}$ -FDG PET/CT in visualization of thrombus from thyroid cancer (4-6).

Recognition of this rare complication by PET/CT can change the management plan and prevent unnecessary long-term anti-coagulation treatment because of wrong diagnosis of cancer-related venous thrombus. Intravenous contrast media administration during PET/CT makes it possible to visualize the thrombus itself and helps to distinguish between benign and malignant metabolically active thrombus (7).

## CASE REPORT

An eighteen year old boy presented with a rapidly growing anterior neck mass. He was subsequently diagnosed as anaplastic carcinoma of the thyroid on histological examination and was referred for PET/CT scan for staging.

The PET/CT scan was done 60 minutes after intravenous injection of 370MBq  $^{18}\text{F}$ -FDG, subsequent to a six hour fast with a whole body Full Ring PET/CT camera (Discovery STE16-GE, USA) which provided three-

dimensional acquisition, processing and display of CT, PET and PET/CT images.

The CT portion was performed according to a soft-tissue protocol, using an intravenous bolus of 100 ml iohexol (Omnipaque 300; GE Healthcare) iodinated contrast 60 seconds before the CT acquisition on a 16-slice scanner. Imaging acquisition and processing parameters were as follows - 120 kVp, with a slice thickness of 3.75mm, bed speed of 17.5 mm/rotation, rotation time 0.8 sec, and a pitch of 1.75. Finally, the acquisition of PET emission images was performed (2 minutes per bed position).

The CT data were used for attenuation correction of PET emission images, and for fusion with PET data for accurate localization of lesions. Non-attenuated data were reconstructed after scan acquisition had been completed. Reconstruction of attenuation corrected data was executed concurrently. All digital images were interpreted on a dedicated ADW workstation.

CECT revealed a heterogeneously enhancing thyroid mass with enlargement and intravascular filling defects in bilateral internal jugular veins consistent with thrombosis.

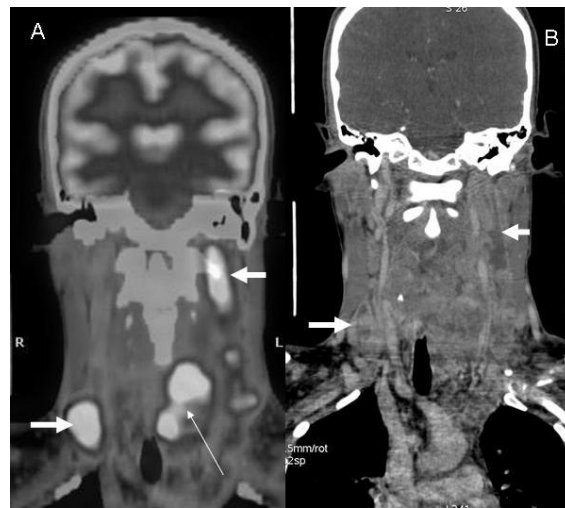
The corresponding PET images showed evidence of diffuse FDG uptake in the thyroid mass with linear bilateral FDG uptake extending from the mass superiorly to the base of the skull, thus confirming the diagnosis of tumor thrombus in bilateral internal jugular veins (Figures 1 to 3).

Additionally, an FDG avid subpleural nodule was noted in the right lower lobe of the lung (Figure 4) suggestive of a metastatic deposit.

The diagnosis of tumor thrombosis was confirmed before treatment with ultrasound Doppler. The patient was subjected to external beam radiotherapy, as the tumor was deemed unresectable. He subsequently succumbed to the disease after 4 months.



**Figure 1.** Axial PET/CT (A) and CECT (B) image at the level of the neck showing large FDG avid heterogeneously enhancing thyroid mass (long thin arrows) with thrombosis in bilateral internal jugular veins (short thick arrows).



**Figure 2.** Coronal PET/CT (A) and CECT (B) image showing FDG avid thyroid mass (long thin arrows) with bilateral internal jugular vein thrombosis (short thick arrows) showing superior extension up to the base of skull on the left side.



**Figure 3.** Left parasagittal PET/CT (A) and CECT (B) image showing left internal jugular vein thrombosis (arrows) extending superiorly up to the base of the skull.



**Figure 4.** Axial PET/CT (A) and CECT (B) image at the level of the thorax showing an FDG avid subpleural nodule (arrow) in the right lower lobe.

## DISCUSSION

Tumour thrombus is a rare complication of many solid cancers including renal cell carcinoma, Wilms' tumour, testicular tumour, adrenal cortical carcinoma, lymphoma, pancreatic cancer, osteosarcoma and Ewing's sarcoma (8). It appears that PET/CT may be helpful in the diagnosis of occult tumor thrombosis and its differentiation from venous thromboembolism. Overall, the CT component of PET/CT, performed without intravenous contrast, could suggest the presence of vascular pathology. The CT component of the PET/CT may be enhanced by the use of contrast, which could provide reliable characterization and anatomic detail of morphological structures. It can also differentiate external compression from intraluminal tumour (9). Combining acquisition of molecular PET with morphological parameters from contrast-enhanced CT thus has the potential to optimize PET/CT imaging. Contrast-enhanced CT defines the extent of thrombotic lesions, while the functional information from PET/CT characterizes the lesions (10). While some investigators suggested that iodine-containing contrast agents may induce artifacts in the CT-generated attenuation map leading to an erroneous radioactivity distribution on the corrected PET images, others have demonstrated no statistically or clinically significant spuriously elevated standardized uptake level as a result of CT iodinated contrast administration. In the present case, since intravenous contrast was administered in the course of the PET/CT study itself, no additional correlative imaging was necessary to characterize the lesions found. The incorporation of CECT in the PET/CT protocol could serve as a one stop shop for delineation of entire tumor extent and spread including intravascular invasion.

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