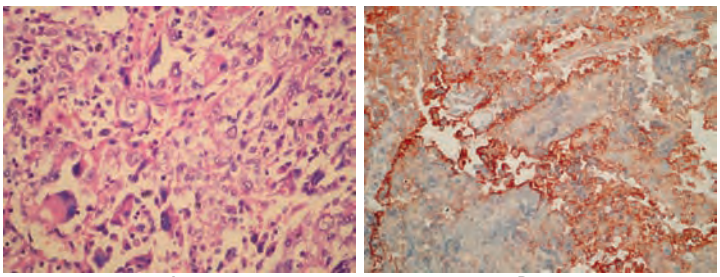
Tumour thrombus from follicular thyroid cancer detected by ^{18}F-FDG-PET/CT

To the Editor: Intravascular and intraatrial invasion of thyroid cancer is not a frequently encountered finding. To our knowledge there are 46 cases [1-14] in the literature reporting tumour thrombus in the mediastinal great veins and/or right atrium due to thyroid cancer. When there is involvement of the superior vena cava and the right atrium, we usually have superior vena cava syndrome (SVCS). Fluoro-18 fluoro deoxyglucose positron emission tomography/computerized tomography (^{18}F-FDG PET/CT) is useful in detecting tumor thrombus and discriminating it from clot of other aetiology. There are two papers reporting the usefulness of ^{18}F-FDG PET/CT in visualization of thrombus from thyroid cancer [2, 4]. It is important to detect the disease early, since thrombectomy can prevent sudden death due to tumor embolism or obstruction of the tricuspid valve.

We report a case of tumor thrombus in the left brachiocephalic vein (LBCV), the superior vena cava (SVC) and the right atrium (RA), in a 45 years old male patient with metastatic follicular thyroid cancer.

A 45 years old male patient underwent total thyroidectomy five months ago and histopathological examination showed follicular type thyroid carcinoma (Fig. 1). Since the remnant thyroid tissue was large and the primary tumor was 4 cm in diameter showing vascular invasion together with multifocality, a second operation was carried out two months later and the patient was treated with 5625MBq of iodine-131 (^{131}I) for thyroid remnant ablation. Post radioiodine ablation scan showed ^{131}I uptake only at the thyroid remnant tissue (Fig. 2A). He then suffered from hoarseness, dysphagia, swelling at the upper chest, face and in both upper extremities for a period of 2 months. His serum thyroglobulin levels were as high as 464ng/dl, while was on supression treatment with levothyroxine. A magnetic resonance imaging (MRI) of the neck and thorax, detected increased signal at the superior vena cava (SVC), suspicious for tumor thrombus (Fig. 2B). Radionuclide venography of the upper extremities with sequential images obtained every 3 sec after the administration of 740MBq ^{99m}Tc-DTPA from both antecubital veins, showed abnormal flow through collateral thoracic veins indicating an obstruction at the level of SVC (Fig. 3).

The patient was referred to our unit for an ^{18}F-FDG PET/CT scan for restaging. After ten hours of fasting and having serum glucose 105mg/dl, the patient was injected with 577.5MBq of ^{18}F-FDG intravenously (i.v.). After 55min of waiting in a semireclined



A B

Figure 1. Histopathological sections showing infiltrating pattern of atypical tumor cells with irregular adenoid structures (hematoxylin-eosin x 400) (A) and immunohistochemical study positive for thyroglobulin (x 200) (B), consistent with the diagnosis of follicular thyroid cancer.

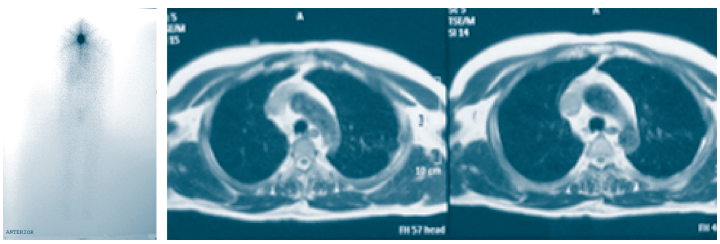


Figure 2. A: Post radioiodine ablation scan (left) shows ^{131}I uptake at the thyroid remnant tissue. B: MR images(right) show increased signal detection at the LBCV and the SVC, creating suspicion for tumor thrombi.

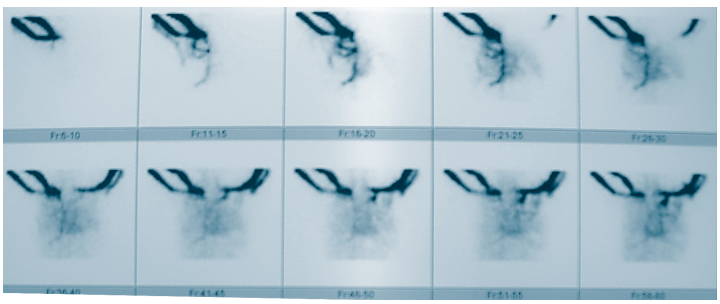


Figure 3. Radionuclide venography study shows abnormal flow through collateral thoracic veins.

relaxed chair, the patient was imaged using an integrated PET/CT scanner which consisted of a full-ring high resolution (HI-REZ) PET with lutetium oxy-orthosilicate (LSO) crystal and a 6-slice CT (Siemens Biograph 6, Chicago, USA). The CT portion of the study was done without an i.v. contrast medium, just for defining anatomical landmarks and making attenuation correction on PET images. Strongly increased ^{18}F-FDG accumulation was detected beginning from LBCV, extending through SVC and ending in the RA (Fig. 4). Maximum standard uptake values (SUVmax) for the LBCV, SVC and RA were 7.0, 7.1 and 6.0 respectively. These findings were interpreted as intravascular involvement of primary thyroid cancer. There were also multiple pulmonary nodules showing moderately increased ^{18}F-FDG accumulation in the parenchyma of both lungs, suggestive of metastases. The patient received external beam radiation treatment (EBRT) to the mediastinum consist-

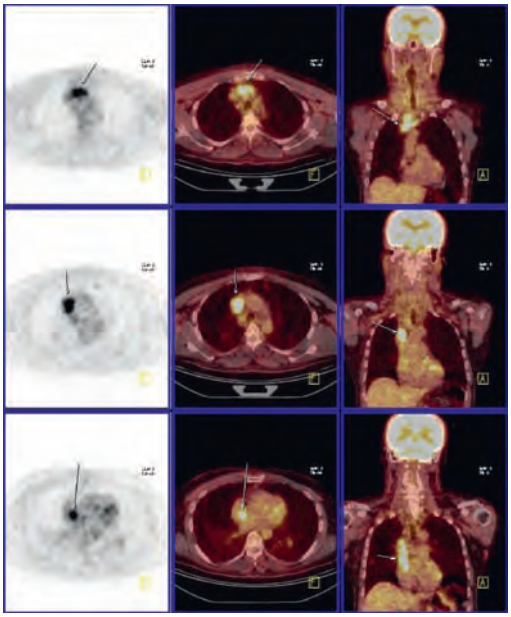


Figure 4. PET-CT study shows increased ^{18}F-FDG uptake at the LBCV (upper row), the SVC (middle row) and the RA (lower row).

ing of 33.5Gy given in 16 fractions over three weeks. He got symptomatic relief and is still being followed up after treated with EBRT.

Out of 46 cases reported in the literature with vascular invation and intraarterial extension of thyroid cancer, 15 were follicular, 13 papillary and 5 cases were anaplastic thyroid carcinoma. The rest of the cases, were insular carcinoma, Hürthle cell carcinoma, adenocarcinoma, medullary carcinoma or sarcoma of the thyroid [1-14]. The heart can be involved in two ways in thyroid cancer. It can either be filled with a tumor extending through the SVC, or involved by remote metastases usually together with widespread metastases [15].

For exact diagnosis and the discrimination of the underlying mechanism of obstruction, CT scanning and MRI may differentiate external compression from intraluminal tumour. Colour Doppler ultrasound may exclude thrombus in the upper extremities. This test has the disadvantage of not being able to show SVC due to the interference of the osseous structures of the thorax or of lung parenchyma. Gallium-67 scintigraphy showed successfully tumour thrombus in a patient with anaplastic thyroid cancer [8]. Radionuclide venography, CT venography and digital subtraction venography can also be used in the diagnosis of tumor thrombus.

Patients may benefit from ^{18}F-FDG PET/CT when tumor thrombus can not be diagnosed exactly by other conventional imaging modalities and may also be helpful in discriminating between benign and malignant thrombus. ^{18}F-FDG uptake in the tumor thrombus results from the increased glycolytic rate of the malignant cells in the thrombus [2]. There are two other cases reported up to now in which ^{18}F-FDG PET/CT detected malignant tumor thrombi from thyroid cancer [2, 4].

Because of the relatively good prognosis of the majority of thyroid cancers and the high possibility of sudden death from tumor embolism or obstruction of the right atrium, it is generally thought that aggressive surgery would be curative or at least prolong survival in patients with tumor thrombosis of the great veins of the mediastinum. Without surgery the patient's quality of life will also decline significantly. In our case the patient rejected operation. Venous obstruction by thyroid cancer may respond dramatically to EBRT and our patient got some symptomatic relief from radiotherapy.

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