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PET/CT features of lung SABR chest wall toxicity

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Summary

Stereotactic ablative radiotherapy offers a radical treatment approach for early stage lung cancers and an aggressive local therapy for pulmonary oligometastases from other tumour sites. Chest wall toxicity is one of the key dose-limiting toxicities for intrathoracic stereotactic treatments. The description of stereotactic radiotherapy chest wall toxicity using functional imaging has not been reported previously. A 56-year-old male received 60 Gy in 8 fractions delivered by volumetric modulated arc therapy for a T1bN0M0 clinical left upper lobe lung cancer. The past medical history included poorly controlled type 1 diabetes mellitus, severe peripheral vascular disease and obesity. The patient attended 9 months later with left-sided, slowly progressive chest pain. An ¹⁸F¹⁸FDG PET/CT performed in order to investigate contralateral pulmonary lesions revealed FDG-avid focal thickening at the left superio-lateral thoracic wall with overlying inflammatory stranding in keeping with an indolent inflammatory process. Chest wall toxicity may present as pain, swelling, fracture and skin changes, and has the ¹⁸F¹⁸FDG PET/CT characteristics of an inflammatory process. Patients with risk factors for chest wall toxicity, such as obesity, diabetes and smoking should be informed of their higher propensity for this clinically significant treatment side effect. For patients developing chest wall toxicity as demonstrated in this case with associated functional imaging findings, anti-inflammatory treatment should be promptly commenced.

Key words: computed tomography; lung cancer; positron emission tomography; radiation oncology; stereotactic ablative radiotherapy.

Introduction

A 56-year-old man received stereotactic ablative radiotherapy (SABR) for a T1bN0M0 peripheral clinical left upper lobe lung cancer staged by ¹⁸F¹⁸FDG PET/CT (Fig. 1). Volumetric arc modulated therapy was used to deliver 60 Gy in 8 fractions, and a sizeable volume of chest wall was noted to receive ≥ 30 Gy (Fig. 2).

The patient attended a District General Hospital Emergency Department 9 months later with left-sided chest pain. The history was that of a slowly increasing pain severity over days, causing sleep disturbance when positioned on his left side. Associated symptoms such as dyspnoea, palpitation, nausea and sweating were absent. The past medical history included atrial fibrillation, myocardial infarction, peripheral vascular disease (PVD), poorly controlled type 2 diabetes mellitus, chronic kidney

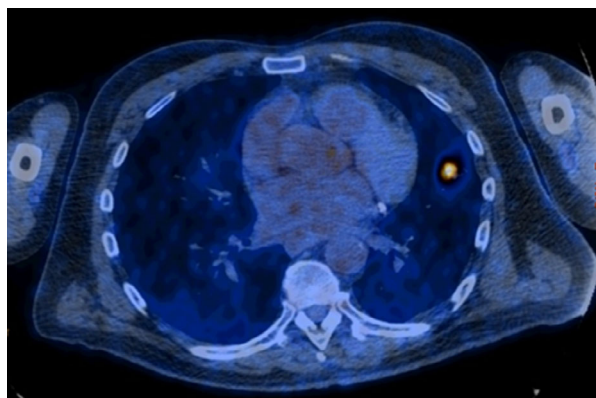


Fig. 1. Staging ¹⁸F¹⁸FDG PET/CT confirming T1bN0M0.

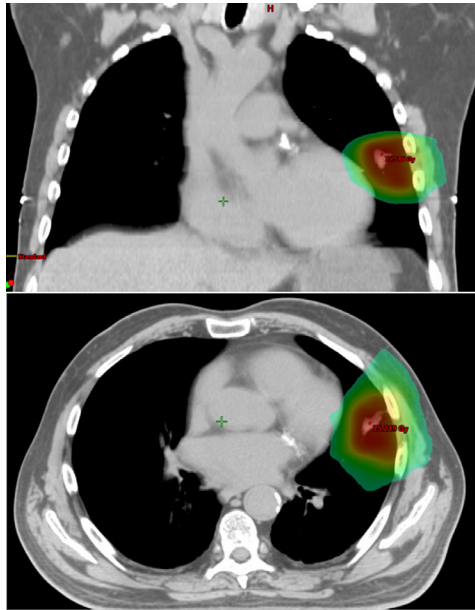


Fig. 2. Planning CT with overlying dose-wash showing the region receiving 30Gy in coronal (top) and axial (bottom) planes.

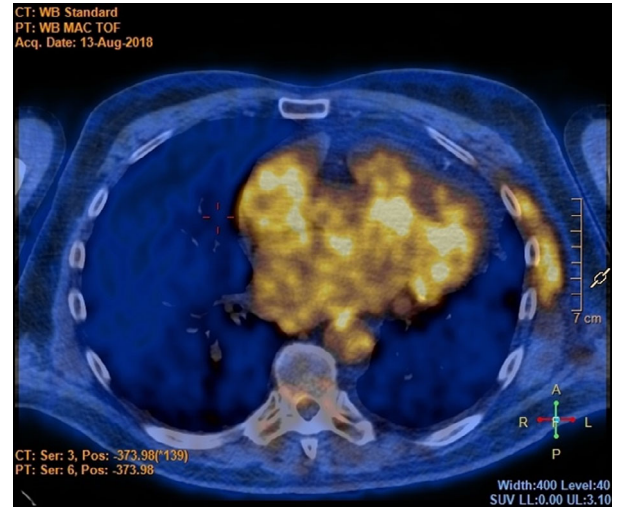


Fig. 3. Axial appearance of SABR CW injury on ^{18}F -FDG PET/CT.

disease and a previous cigarette smoking history. As multiple electrocardiograms, serial highly sensitive serum troponin T assays and the chest radiograph were unremarkable, a diagnosis of non-cardiac chest pain was reached. The patient was discharged with mild opiates.

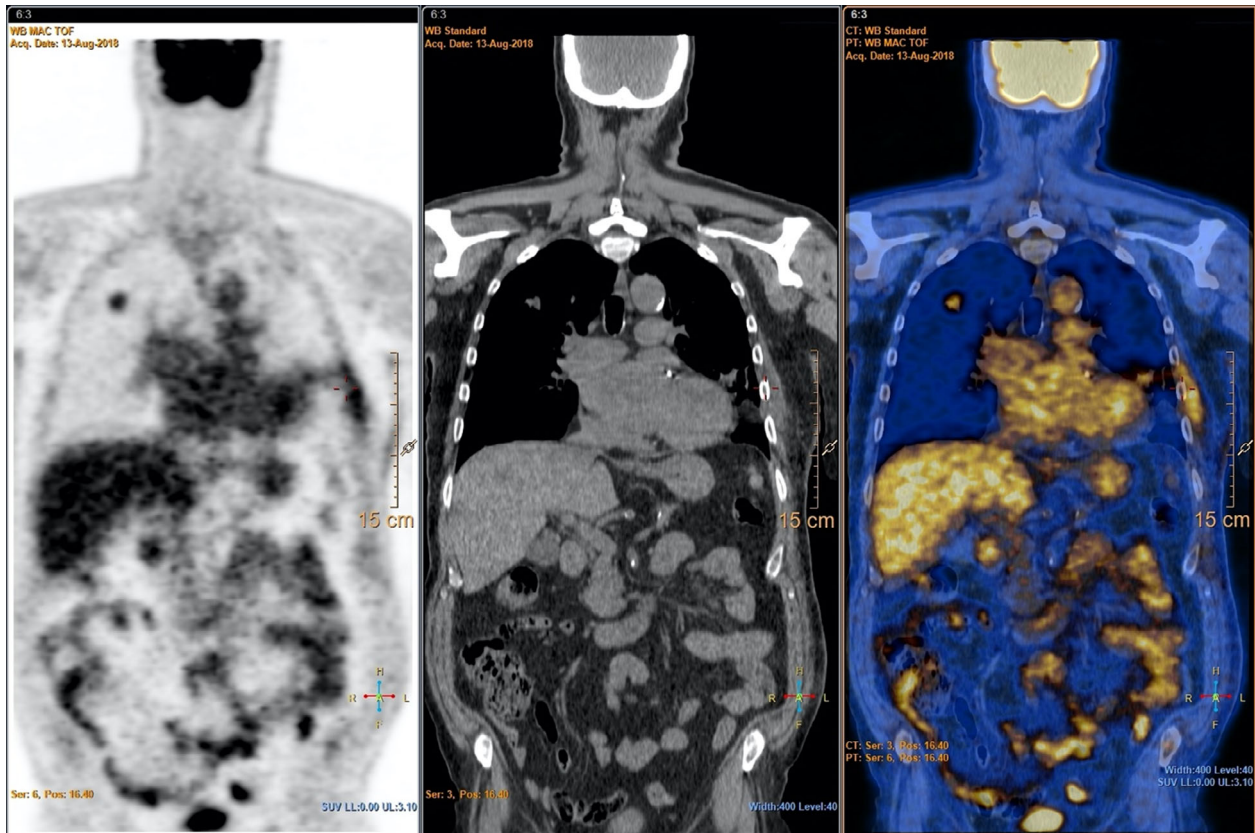


Fig. 4. Coronal appearance of SABR CW injury on ^{18}F -FDG PET/CT.

At a planned Oncology appointment as part of routine SABR follow-up 10 days later, the pain severity was persistent despite good adherence to maximal dosage of mild opiates. On examination, there was a 6 × 6 cm firm and tender swelling of the left-sided axillary chest wall (CW) without erythema. The examination findings correlated with the level of the tumour on the original diagnostic cross-sectional imaging, and thus a clinical diagnosis of grade 3 CW radiation toxicity was reached. Topical opiates were added to his medicines with a modest symptomatic benefit derived. Although anti-inflammatories were contraindicated, the symptoms resolved completely over two months. The patient expired 3 months later due to complications of PVD.

Immediately prior to Oncology review, a planned ¹⁸F-FDG PET/CT investigating contralateral pulmonary lesions was performed. Retrospective review of the left CW appearances on CT revealed focal thickening with overlying inflammatory stranding at the left superio-lateral thoracic wall (Figs 3,4). The SUV was estimated at 3.7, which was mildly above the background blood pool. These features were felt to be in keeping with an indolent inflammatory process. To the authors' knowledge, the PET/CT appearances of SABR CW toxicity have not been published previously.

Radiation Oncologists using SABR to treat early lung cancers and thoracic oligometastatic cancer routinely prospectively consent patients regarding the possibility of CW toxicity. All-grade CW toxicity is reported in 10% cases, with 2% having grade 3 events, despite increasingly complex radiotherapy planning and delivery.¹ Multiple studies have demonstrated a correlation between treatment factors, such as dose received and volume of tissue irradiated, but there is a lack of consensus on dose constraints.²

CW toxicity symptoms such as radiation dermatitis, pain and rib fracture typically occur in the months to years after SABR treatment.^{3,4} Clinical factors such as diabetes mellitus, obesity, smoking and younger age are also relevant risk factors in this case.⁵ Consideration should be given to more specific anti-inflammatory therapy such as corticosteroids for CW toxicity, given the underlying inflammation observed in this case on PET/CT imaging.

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