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No needle to fear: An approach to needle phobic patients

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ABSTRACT

^{18}F-FDG is the most commonly used radioisotope in PET scanning and is administered intravenously. When patients cannot cannulated, there are limited options available for functional tumour assessment. A fifty year old male presented for investigation of a suspected lung carcinoma identified during investigation of pneumonia. The patient had a severe needle phobia, intellectual disabilities and multiple co-morbidities which made cannulation impossible. An alternative administration method was sought, with successful oral administration occurring in both staging and restaging scans. The scans demonstrated resolution of a suspected lung cancer indicating it was an inflammatory/infective process, preventing the need for more invasive investigative approaches. A non-invasive and positive experience allowed for accurate diagnosis and repeat imaging for this patient, enabling follow up imaging to occur. It is reported that oral administration of ^{18}F-FDG may be useful for assessment of suspected cancers for patients where cannulation isn't possible, when limitations are taken into consideration.

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Introduction

2-[^{18}F]-Fluoro-2-deoxy-D-glucose (^{18}F-FDG) has played a significant role in medical imaging since its inception in 1976 (1). Positron emission tomography (PET) radiopharmaceuticals such as ^{18}F-FDG are routinely administered intravenously, however there are examples of oral and intramuscular methods of administration in the literature (2). Unfortunately, not all patients attending an imaging department present with adequate peripheral venous access or have other extenuating circumstances. Clinical reports and animal studies identify that oral ^{18}F-FDG administration is a practical method where cannulation is not possible (3), as occurred in the patient to be described.

Case Description

A 50 year old patient with intellectual disabilities and suffering multiple co-morbidities was assessed for an upper right quadrant lung mass. Clinical history confirmed community acquired pneumonia diagnosed during a hospital admission for fevers, cough, sputum production and elevated C-reactive protein. The patient suffered from extreme needle phobia, trypanophobia, making cannulation impossible. Due to concern of an underlying malignancy, the aim was to provide an alternate method of ^{18}F-FDG administration. The use of a general anaesthetic was considered but thought to be inappropriate due to the risk to the patient. The risks were as a result of the patients complicated medical history and lack of access to equipment and appropriate staff in the medical imaging department.

Routine blood glucose levels are considered essential for determining the potential diagnostic quality of a PET scan, however were not obtained due to trypanophobia and the patients limited capabilities. As such, for both initial staging and response assessment PET scans six months later, a strict fasting protocol was followed and confirmed by the patient's carer. The patient was orally administered 304.5 MBq which was diluted into 25 ml H2O and consumed via a straw followed by 300 ml of water. Whole body PET images, from

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vertex to upper thighs, with low dose computed tomography (ldCT) were acquired at 107 minutes post administration, for the initial staging scan, using a Siemens Biograph mCT Flow PET/CT. The PET study showed significant ^{18}F-FDG accumulation in a well-defined lesion in the right lung with maximum standardized uptake values (SUV_{max}=12) .

A 2.7×2.9×3.9 cm3 intensely avid right upper lobe spiculated lung mass was identified on the initial staging PET scan, corresponding with the mass like consolidation identified on the initial CT scan (Figure 1).

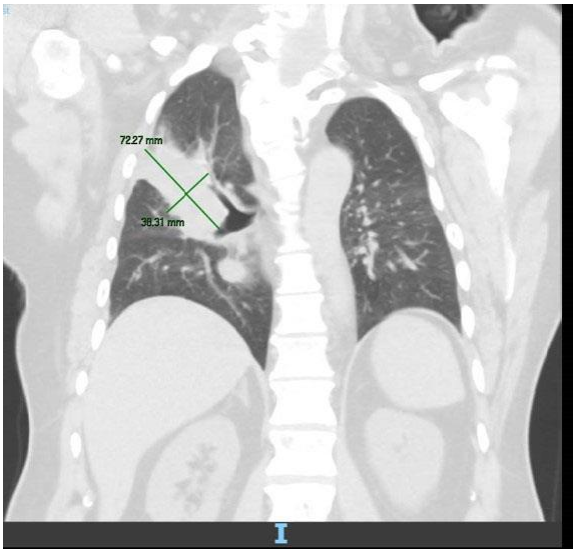

Figure 1. Initial computed tomography (CT) during hospital admission

Residual high activity was noted in the mouth and bowel as a result of the administration method as evident in Figures 2a and 2b. No further abnormalities were observed. Biopsy of the lesion identified the presence of inflammatory cells, thus antibiotic treatment was commenced. Repeat CT scan two months later showed a reduction in mass size, although malignancy could not be conclusively excluded. The six month follow up PET scan, Figure 2a, was conducted at 131 minutes post oral administration of 312 MBq of ^{18}F-FDG in the method described previously. These images identified a significant reduction in size and avidity of the mass, with results best explained by the presence of an inflammatory or infective process. Quantification of SUV_{max} of the lung lesion found a decrease from 12 to 2 over the six month duration.

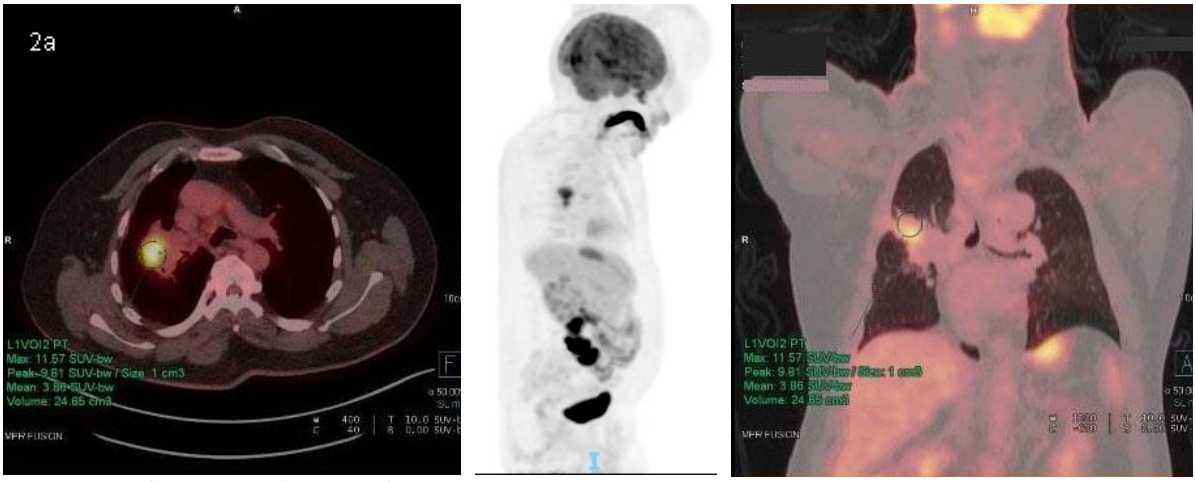

Figure 2a. Initial ^{18}F-FDG PET/CT scan and MIP images

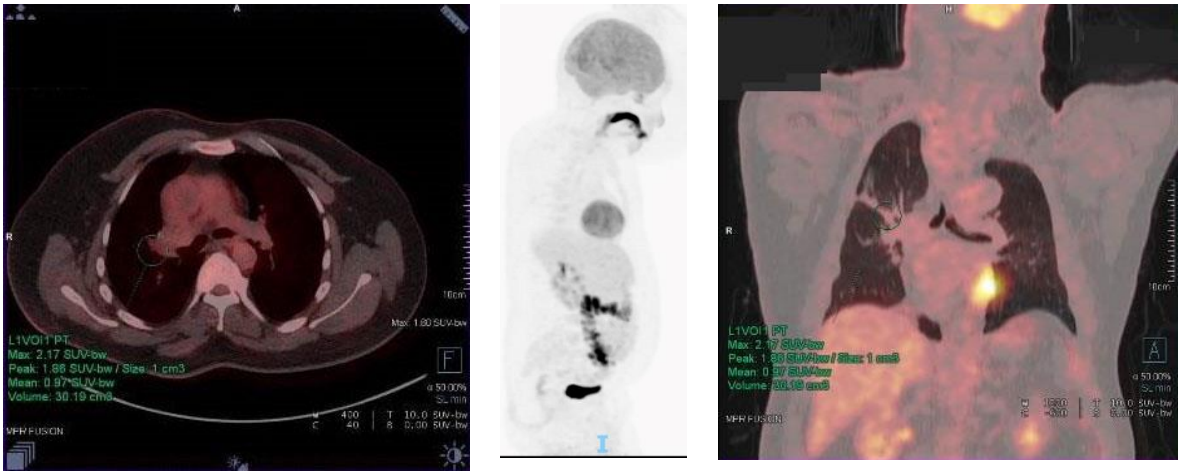

Figure 2b.6 month follow up ^{18}F-FDG PET/CT scan and MIP

Discussion

While ^{18}F-FDG is most commonly administered intravenously, peripheral venous access cannot always be established. Patient phobias such as nosocomephobia, trypanophobia and claustrophobia can create significant challenges for medical imaging teams. It can lead to either refusal to cooperate or poor patient compliance resulting in non-diagnostic quality images. Using tools such as distraction, virtual reality goggles, music or reducing pain with topical anaesthetics can alleviate patient fears in some instances, however, sometimes this remains futile. Alternate radiopharmaceutical delivery methods such as oral administration may provide a practical solution replacing intravenous administration of ^{18}F-FDG (2). Patients can then successfully complete their required imaging with a positive experience, enabling follow up scans with minimal anxiety .

The mechanism of oral ^{18}F-FDG uptake occurs through the epithelial lining of the small intestine where it is absorbed into the portal blood supply and greater circulation (4). While slower than intravenous administration with delayed peak organ activities, oral ^{18}F-FDG localisation occurs in a similar way to the traditional administration method (5). This method of localisation can complicate the identification of abdominal disease due to the residual gastric and bowel retention, as evident in a study by Franc (6) where uptake time was 40 minutes post injection. To allow for this, Nair et al (5) suggests imaging occurs at 60-90 minutes post administration, though studies by Kim et al (2) and by Srinivasan (7) identified oral administration methods are not comparable to intravenous methods until 120 minutes post administration. The absence of stomach uptake in our study agrees with the findings of Srinivasan (7), that the intensity of gastric uptake decreases over a longer uptake period. Nair et al also reported lesions identified following intravenous administration were also seen following oral administration. Variation in SUV_{max} values calculated for each method could be attributed to the uptake mechanism (5). As the patient was assessed for a suspected lung lesion, residual gastrointestinal uptake did not affect the scan outcome.

Oral administration of ^{18}F-FDG in this case was critical to providing functional assessment of the lung lesion. Whole body imaging, from vertex to upper thighs, also provided the opportunity for screening with only a minimal increase in total radiation exposure resulting from the whole body ldCT, to rule out malignancy, ensuring the most appropriate management of this patient. The patient's response to antibiotic therapy, as evidenced in the sequential ^{18}F-FDG PET studies, prevented the need for further interventions such as general anaesthetic or a more invasive surgery. Without PET imaging, metabolic response of the mass to antibiotic treatment could not be evaluated. The oral delivery of ^{18}F-FDG provided this patient with a positive experience and provision for repeat studies which were crucial to his medical management.

Conclusion

Utilisation of an oral administration technique for ^{18}F-FDG PET scans is a valid option when cannulation is not possible. An understanding of its limitations due to bowel localisation and retention is important when assessing the appropriateness of this technique. Methods to optimise the diagnostic quality such as increased uptake time to account for altered biodistribution help to optimise scan quality. This case highlights the opportunity to provide diagnostic quality images for a broader patient population such as

cancer patients with difficult venous access and those with severe needle phobia.

Declaration of patient consent

The authors declare that all appropriate consent forms have been obtained from participants involved in this study.

The authors declare no conflict of interest.

Ethics

Ethics approval was waved by administering hospital.

Conflicts of Interest

There are no conflicts of interest.

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