Value of delayed 18F-FDG PET in the diagnosis of solitary pulmonary nodule

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ABSTRACT Performing dual point 18F-FDG PET scans of solitary pulmonary nodules at an initial SUV (max) <2.5 is a useful technique. However, prolonging second image acquisition from 120 to 180 min does not appear to improve accuracy. Dual time 18F-FDG PET is not useful in differentiating benign and malignant pulmonary nodules with an initial mean SUV ≤2.5 in parts of the world where granulomatous disease is prevalent. Prolonged imaging on PET scanners is expensive particularly where availability if these scanners is limited. Further prospective research is required to define the potential benefits of dual time point 18F-FDG PET imaging, before recommending routine use of the technique.

KEY WORDS Solitary pulmonary nodules; dual-point scan18F-FDG PET scans

J Thorac Dis 2013;5(3):373-374. doi: 10.3978/j.issn.2072-1439.2013.06.05

The introduction of PET-CT in the 90s revolutionised the practice of thoracic oncology and was widely adopted and considered a milestone in staging thoracic tumors. PET-CT scan retains a crucial role in thoracic oncology due to its impact on diagnosis, staging and prognosis. However, the differential diagnosis of a solitary pulmonary nodule (SPN) is wide and includes granuloma, hamartoma, and primary lung cancer and lung metastases. Characteristics such as calcified nodules regarded as benign are not immune from harbouring malignancy (1). 18F-FDG PET is frequently used in characterizing SPN and is a useful technique (2,3). In the evaluation of SPN, SUV (standardized uptake value) of ≤2.5 is used frequently as a cut-off point of criterion for malignancy. However, FDG is not tumor-specific, and increased uptake is seen in many other lung nodules that are benign. When, such criteria are used there is considerable overlap of benign and malignant SPNs (4-6). Moreover, many malignant tumors show only minimal uptake and would, therefore, be excluded when using SUV of ≤2.5 (4-6). The present study (7) used delayed images 18F-FDG PET imaging in diagnosis of SPNs on 28 patients, improving accuracy of evaluation of SPNs with only borderline levels of increased metabolic activity thus avoiding invasive procedures. Four recent studies support this proposition and have achieved similar results (8-11) using dual point time (DPT) FDG-PET scanning. Macdonald and associates used a DPT FDG PET imaging, prolonging second image acquisition from 120 to 180 min. This procedure did not improve the accuracy of the technique. Nevertheless, given that maximal FDG uptake in malignant nodules is thought to be in the region of 5 hours, the authors suggested that a more significant delay in imaging might improve the diagnostic yield. Schillaci and associates in their small series of patients, showed comparable accuracies with early and delayed SUV max, whereas morphological and contrast enhanced CT evaluations showed the lowest accuracies. However, DPT SUV max was most sensitive, whereas single-time-point (SPT) SUV max was most specific. Chen found delayed FDG PET not useful for differentiating benign and malignant SPNs with an initial mean SUV less than 2.5 in geographic regions with endemic granulomatous disease. However, DPT PET improved accuracy. Xiu Y and associates found that DPT FDG PET imaging had the potential for improving accuracy of imaging in the evaluation of lung nodules with only borderline levels of increased metabolic activity.

Sebro and associates (12) found that in areas of 'high endemic granulomatous disease' the PET/CT threshold max SUV of 2.5 retains a high sensitivity (95.1%) and positive predictive value (90.6%) for differentiating benign from malignant pulmonary lesions; however, the specificity (45.5) and negative predictive value (62.5) decrease due to increased false positives. The study also found that the presence of emphysema and absence of evidence of granulomatous disease increases the probability that a SPN is malignant; however, they did not find the findings statistically significant.

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Submitted May 29, 2013. Accepted for publication Jun 05, 2013.
Available at www.jthoracdis.com

ISSN: 2072-1439

A recent meta-analysis (13) concluded that DPT FDG-PET had similar sensitivity and specificity to SPT FDG-PET in the diagnosis of SPNs. The authors conclude that the additional value of DPT FDG-PET is questionable, primarily because of the significant overlap of benign and malignant nodules FDG-PET characteristics and lack of consensus criteria for quantitative thresholds to define nodules as malignant.

A further meta-analysis (14) did not support the routine use of DPT imaging with 18F-FDG PET in the differential diagnosis of SPNs, but added that the technique might provide additional information in selected cases with equivocal results from initial scanning. The authors added that further prospective research is required might better define the potential benefits of DTP 18F-FDG PET imaging.

A meta-analysis by Zhang and associates (15) showed similar accuracy of DTP 18F-FDG PET/CT and STP 18F-FDG PET/CT has similar accuracy in the differential diagnosis of SPNs. However, DTP 18F-FDG PET/CT appeared to be more specific than STP 18F-FDG PET/CT.

The data so far available suggests DTP FDG PET imaging, is a useful technique in evaluating SPN with an initial SUV (max) <2.5. However, prolonging second image acquisition from 120 to 180 min does not appear to improve the accuracy of this technique. Comparable accuracies occur with early and delayed SUV max. However, DTP SUV max is most sensitive, whereas STP SUV max is more specific. DTP FDG PET imaging has the potential for improving accuracy in the evaluation of SPNs with only borderline levels of increased metabolic activity. However, the maximal FDG uptake in lung cancer occurs around 5 hours, improving the accuracy of DTP FDG PET imaging by a further delay in the second image acquisition in this subgroup with equivocal FDG uptake. DTP FDG PET is not useful in differentiating benign and malignant SPNs with an initial mean SUV ≤2.5 in parts of the world where granulomatous disease is prevalent. Prolonged imaging on PET scanners is expensive particularly where availability if these scanners is limited. Further prospective research is required to define the potential benefits of DTP 18F-FDG PET imaging, before recommending routine use of the technique.

Acknowledgements

Disclosure: The author declares no conflict of interest.

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Cite this article as: Khan AN, AL-Jahdali H. Value of delayed 18F-FDG PET in the diagnosis of solitary pulmonary nodule. J Thorac Dis 2013;5(3):373-374. doi: 10.3978/j.issn.2072-1439.2013.06.05