

The importance of appropriate reporting and investigation of incidental findings on computed tomography attenuation correction images during myocardial perfusion scintigraphy

ABSTRACT

We present a case of lung cancer incidentally detected as a pulmonary nodule on computed tomography attenuation correction (CTAC) images during myocardial perfusion scintigraphy (MPS). Unfortunately, the incidental lesion was not fully investigated following MPS report and had developed into metastatic lung carcinoma when diagnosed over 1 year later, with failure of subsequent emergent chemotherapy. The disease appeared to be localized when initially detected during MPS. This case highlights the importance and potential clinical value of routine review of CTAC images in MPS with appropriate reporting and further investigation of suspicious incidental findings. In addition, the importance of effective communication between nuclear medicine department and treating team is clear to ensure suspicious incidental findings are given sufficient credence and thoroughly investigated promptly to avoid adverse clinical outcomes.

Keywords: Computed tomography attenuation correction, incidental findings, low-dose computed tomography, lung carcinoma, myocardial perfusion scintigraphy

INTRODUCTION


An incidental finding is one which is unexpected and unrelated to the primary indication for an investigation. They are particularly commonly encountered within the thorax on computed tomography (CT) imaging.^[1] Any incidental finding which is of clinical concern for the potential to cause harm or provide benefit to the patient if reported is significant and generally necessitates further evaluation. The correct approach to dealing with incidental findings is an increasingly difficult challenge throughout medical imaging. Important steps to ensure they are managed appropriately include careful review of all acquired images, accurate reporting of unexpected findings in official imaging reports, clear communication between medical imaging department and treating teams, and evidence-based further investigation. Failure or delay at any stage can result in adverse clinical outcomes.

The accuracy of myocardial perfusion scintigraphy (MPS) in the evaluation of myocardial ischemia can be enhanced with the use of a low-dose CT scan to provide attenuation correction of the functional images.^[2] This nondiagnostic CT acquired without breath-holding, or intravenous contrast produces low-resolution images of a sizeable portion of the thorax and upper abdomen as a by-product. Potentially significant incidental findings on these CT images have been reported in 2%–33% of MPS studies, with cases of previously undiagnosed malignancy described in previous published

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Access this article online	
Website: www.wjnm.org	Quick Response Code 
DOI: 10.4103/wjnm.WJNM_19_18	

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How to cite this article: Delaney FT, Gray EL, Lee JC. The importance of appropriate reporting and investigation of incidental findings on computed tomography attenuation correction images during myocardial perfusion scintigraphy. World J Nucl Med 2019;18:74-6.

reviews^[3-6] and a solitary case report.^[7] Despite this, the most appropriate approach to reviewing and reporting on these CT images and any incidental findings is controversial and has recently been advised against.^[6,8]

CASE REPORT

We present the case of a 74-year-old man who underwent MPS for evaluation of increasing dyspnea as part of a preoperative assessment before potential abdominal aortic aneurysm repair. He was a retired builder who was an ex-smoker of 25 pack-years with a past medical history including ischemic heart disease, severe chronic obstructive pulmonary disease, and tissue aortic valve replacement.

MPS with technetium-labeled hexakis-2-methoxyisobutyl isonitrile (Sestamibi, Cardiolite®, Lantheus Medical Imaging, North Billerica, MA, USA) as the radiopharmaceutical and adenosine as a pharmacological stressor showed no evidence of myocardial ischemia, and this was confirmed with automated analysis. However, a subpleural opacity in the posterior aspect of the right lower lobe was seen on review of the CTAC images [Figure 1a]. The corresponding slice on single-photon emission CT (SPECT) fused with CT is also shown [Figure 1b]. This measured 10 mm and was noted in the official MPS report. In accordance with current clinical guidelines for the management of lung nodules, further evaluation with full-dose diagnostic CT was recommended in the MPS report provided to the referring physicians.^[9] Interestingly, there was no radiopharmaceutical (sestamibi) uptake associated with the tumor.

The patient had undergone multiple CT examinations of the thoracic and abdominal aorta, which included the region where the incidental CTAC nodule was located, under the care of the vascular team in the years prior to the MPS taking place (most recently 1 year before MPS), but no lung nodules/opacities had been reported. A further CT aorta

took place 2 months following MPS which reported that the nodule now measured 12 mm and was suspicious for malignancy [Figure 2a and b]. Unfortunately, no further urgent investigation was performed based on the MPS report or this CT.

The next imaging study performed was another CT scan, which occurred 14 months after MPS. This revealed that the pleural based opacity in the right lower lobe had grown to 23 mm and was now associated with multiple smaller opacities within the left lung and hilar lymphadenopathy [Figure 3a and b]. An urgent biopsy was performed at this point providing a histological diagnosis of lung squamous cell carcinoma. Staging CT showed diffuse hepatic metastasis [Figure 4a and b]. Emergent chemotherapy was started, but the patient died within weeks of its commencement.

DISCUSSION

In this case, there was a delay of over 12 months in fully investigating the incidental pulmonary nodule seen on CTAC images during MPS and again on CT aorta 2 months later. This was despite the MPS, and CT reports clearly recommending further investigation. When initially described incidentally during MPS, the nodule was localized with no evidence of regional or distant metastasis. Appropriate investigation and earlier diagnosis may have allowed for greater treatment options, and potentially, a better outcome as the prognosis of lung cancer is closely linked to disease stage.^[10] The exact reason for the failure to investigate sooner is unclear.

Lung cancer is the leading cause of cancer death worldwide. As it is often asymptomatic in the initial stages, it can potentially be diagnosed incidentally on unrelated investigations.^[10] As lung cancer and ischemic heart disease share common risk factors, particularly cigarette smoking, patients undergoing MPS already represent a high-risk group. Moreover, low-dose

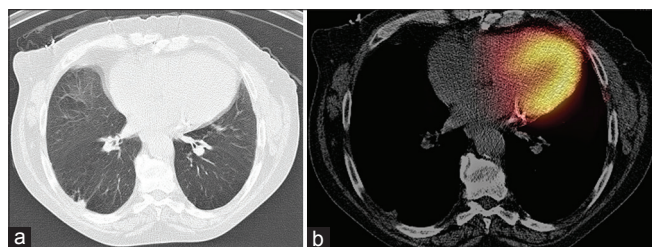


Figure 1: Selected axial low-dose computed tomography (a) image acquired for attenuation correction during myocardial perfusion scintigraphy (acquired in prone position). An incidental 10 mm opacity is seen within the right lower lobe. Further evaluation with full-dose diagnostic-quality computed tomography was recommended. Anatomical equivalent (b) shown on single-photon emission computed tomography

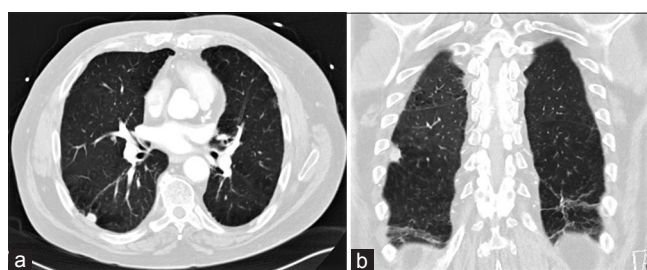


Figure 2: Selected axial (a) and coronal (b) computed tomography images from a CT aorta study Performed 2 months following myocardial perfusion scintigraphy. An incidental right lower lobe opacity, now measuring 12 mm is seen. Urgent further investigation was advised due to suspicion for malignancy

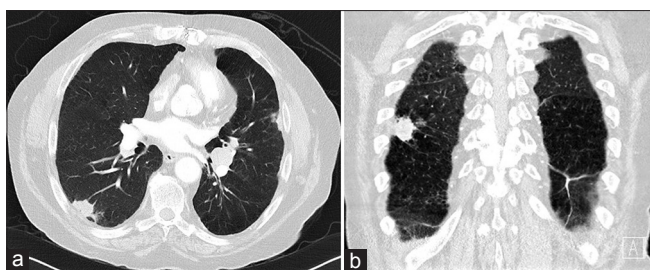


Figure 3: Selected axial (a) and coronal (b) computed tomography images from a CT chest performed 14 months after the initial myocardial perfusion scintigraphy occurred. A 23 mm opacity was now present within the right lower lobe with associated hilar lymphadenopathy and multiple smaller opacities within the lung fields. Subsequent computed tomography-guided biopsy revealed lung squamous cell carcinoma

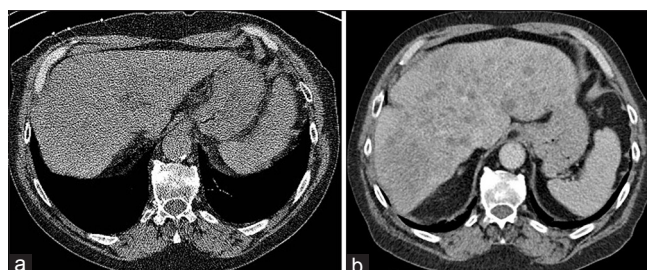


Figure 4: Selected axial computed tomography images from (a) low-dose attenuation correction CT acquired during myocardial perfusion scintigraphy (acquired in prone position) and (b) staging computed tomography performed following lung cancer diagnosis 14 months later. Within the limits of the lower dose scan, no hepatic lesions are seen at the time of myocardial perfusion scintigraphy compared with multiple metastatic lesions on staging computed tomography

CT has emerged as an effective screening tool for lung cancer in recent years, reducing mortality in high-risk groups with a significant exposure to cigarette smoking.^[10] MPS with CTAC provides a low-dose CT through a considerable portion of the lung fields in a patient population at higher risk for lung cancer development, and although it cannot be directly compared to full-dose diagnostic CT or a structured screening program, can identify early cancers as shown here. This highlights the need for routine reporting and appropriate follow-up of incidental lung nodules on CTAC images during MPS.

CONCLUSION

This case highlights the importance of routine review of CTAC images in MPS and the crucial role of effective communication between nuclear medicine and treating physicians following identification of any suspicious incidental finding. Further, referring physicians must follow-up and appropriately investigate potentially significant incidental findings promptly, particularly as they can represent undiagnosed malignancy as in this case. Failure at any step can result in adverse patient outcomes.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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