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Non-conventional imaging of lung cancer

M. Bellomi

European Institute of Oncology, Via Ripamonti 435, 20141 Milan, Italy

Corresponding address: Massimo Bellomi, European Institute of Oncology, Via Ripamonti 435, 20141 Milan, Italy. Email: massimo.bellomi@ieo.it

Abstract

This presentation discusses the optimum magnetic resonance imaging (MRI) sequence for lung cancer assessment in a clinical setting, and the sensitivity and specificity of MRI (alone and in combination with diffusion-weighted imaging (DWI)-MR) compared with those of computed tomography (CT) and fluorodeoxyglucose-positron emission tomography (PET) for lung cancer staging. The role of perfusion studies (by CT or MRI), of DWI-MRI, blood oxygenation level dependent sequences and PET in defining the aggressiveness of lung tumours and in evaluating the response to radiochemotherapy is also discussed.

Keywords: *Lung cancer; computed tomography; magnetic resonance imaging; diffusion-weighted MRI.*

Computed tomography (CT) has an established role in lung cancer detection and staging, as well as in monitoring the response to therapy. [^{18}F]Fluorodeoxyglucose (FDG)-positron emission tomography (PET) has shown potential for lung nodule characterization (benign vs malignant) and tumour staging, with the ability to detect distant metastases that may not be imaged by CT; FDG-PET has also been used for monitoring response to therapy.

The vascularity of pulmonary nodules (SPN) has been used for their characterization in everyday radiological practice for many years, by means of post-contrast enhancement; nowadays the role of perfusion CT is being investigated. There are several technical limitations to this method: artefacts from respiratory movement and beam hardening, small size and position of the nodule, morphological characteristics and nodule density. These, together with the associated significant radiation exposure, limit the implementation of CT perfusion imaging in lung tumours.

With the development of high field intensity magnets (1.5–3 T) for clinical magnetic resonance imaging (MRI), which allow both high temporal and spatial resolution sequences, some researchers have investigated the feasibility and the potential of MRI for lung cancer assessment, as no ionizing radiation is involved in this imaging technique. Studies from Schroeder *et al*.[1] and from Vogt *et al*.[2] have demonstrated high sensitivity (94–95%) using MRI for lung nodules greater than 5 mm. This is lower than that of multidetector CT, but is comparable with that of FDG-PET.

MRI has a role for lung cancer staging. It is superior to other imaging modalities in Pancoast tumours for evaluating tumour extension to the intervertebral neural foramina, the spinal cord and brachial plexus, primarily because of higher contrast resolution and the multiplanar capability available with MRI technology[3]. MRI may have a role in mediastinal invasion assessment. Although the sensitivity and specificity of CT ranges from 40 to 84% and from 57 to 94%[4], the superior contrast resolution of MRI may confer an advantage over CT for advanced stage tumours invading the pericardium (T3) or heart (T4), as well as hilar structures.

In addition, with the development of diffusion-weighted imaging by MR (DWI-MR), which has the capability to assess tissue cellularity, MRI has potential as a functional imaging technique. Some studies have demonstrated comparable performances of DWI-MR and FDG-PET for tumour detection and staging, as well as for monitoring therapy, in some body tumours. Preliminary data from comparisons of FDG-PET and DWI-MR for differentiating malignant and benign pulmonary nodules[5,6] present encouraging results for DWI-MR.

We will discuss:

- The optimum MRI sequence for lung cancer assessment in a clinical setting

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- The sensitivity and specificity of MRI (alone and in combination with DWI-MR) compared with those of CT and FDG-PET for lung cancer staging
- The role of perfusion studies (by CT or MRI), of DWI-MRI, blood oxygenation level dependent sequences and PET in defining the aggressiveness of lung tumours and in evaluating the response to radiochemotherapy.

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