IMAGES IN THORAX

^{18}F-Misonidazole PET-CT scan detection of occult bone metastasis

Daniel R McGowan,[1,2] Ruth E Macpherson,[3] Kevin M Bradley,[3] John D Fenwick,[1] Fergus V Gleeson,[1,3] Geoff S Higgins[1]

[1]Department of Oncology, University of Oxford, Oxford, UK
[2]Radiation Physics and Protection, Oxford University Hospitals NHS Trust, Oxford, UK
[3]Department of Radiology, Oxford University Hospitals NHS Trust, Oxford, UK

Correspondence to
Daniel R McGowan, Department of Oncology, University of Oxford, Oxford OX3 7DQ, UK; daniel.mcgowan@oncology.ox.ac.uk

Received 8 June 2015
Revised 10 August 2015
Accepted 14 August 2015
Published Online First 8 September 2015

A 67-year-old man with locally advanced non-small cell lung cancer entered a phase I trial combining a novel phosphoinositide 3-kinase inhibitor (BKM120) with palliative radiotherapy.[1] The trial uses ^{18}F-misonidazole (FMISO) positron emission tomography (PET)-CT imaging to assess any changes in tumour hypoxia. FMISO is a tracer currently only used in the research setting.

A pretreatment FMISO PET-CT scan identified an occult, asymptomatic scapular metastasis (figure 1) undetectable on routine CT imaging (figure 2A). This was subsequently confirmed on MRI imaging. The patient was referred for palliative chemotherapy upon completing the trial. To our knowledge, this is the first published report of FMISO PET-CT detecting an occult metastasis. The FMISO image (figure 1) also shows hypoxia within mediastinal nodes. The enlarged nodes were seen on the routine CT imaging (figure 2B) unlike the occult scapular metastasis.

FMISO is reduced and retained in hypoxic tissue and so allows the identification of hypoxic volumes. Tumour hypoxia is associated with marked resistance to radiotherapy and poor clinical outcomes.[2] There is significant interest in using FMISO PET-CT to monitor changes to tumour hypoxia arising from drug or radiotherapy treatment. FMISO images also identify hypoxic volumes of the tumour that may benefit from boosting the radiation dose. This image illustrates that small tumour volumes may harbour clinically relevant regions of hypoxia.

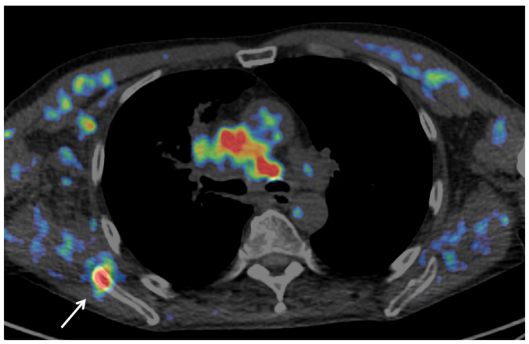

Figure 1 ^{18}F-Misonidazole positron emission tomography (PET) image fused with the corresponding CT displayed on a tumour-to-blood ratio (TBR) colour scale. Red regions depict a TBR >1.4, indicating hypoxia, and no visible PET depicts a TBR <1, indicating normoxia.[3] This axial image shows the unexpected hypoxic bone metastasis indicated by the white arrow in addition to hypoxic nodal disease in the mediastinum.

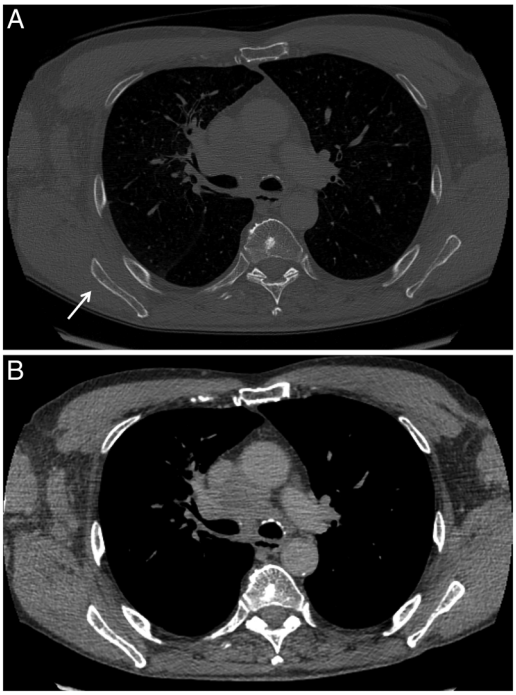

Figure 2 CT contrast-enhanced image reformatted using 1.25 mm axial thickness for (A) a bone reconstruction showing that the bone metastasis visible on ^{18}F-misonidazole (FMISO) positron emission tomography (PET) is not visible on CT and (B) standard reconstruction showing the enlarged mediastinal nodal disease shown to be hypoxic on the FMISO PET.

Contributors All authors wrote, revised and approved the final manuscript.

Funding The trial was supported by Cancer Research UK (CRUKD/12/016), the National Institute of Health Research (NIHR), Health Education England (HEE), the Oxford ECMC, the CRUK EPSRC Oxford Cancer Imaging Centre, the CRUK Oxford Centre and Novartis.

Competing interests None declared.

Patient consent Obtained.

Ethics approval Oxford REC.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

1 University of Oxford. A CR-UK Phase I Study of BKM120 in Patients With Non-small Cell Lung Cancer (NSCLC) Receiving Thoracic Radiotherapy. http://www.clinicaltrials.gov/ct2/show/NCT02128724 NLM Identifier: NCT02128724
2 Moeller BJ, Richardson RA, Dewhirst MW. Hypoxia and radiotherapy: opportunities for improved outcomes in cancer treatment. *Cancer Metastasis Rev* 2007;26:241–8.
3 Koh WJ, Rasey JS, Evans ML, *et al*. Imaging of hypoxia in human tumors with [F-18]fluoromisonidazole. *Int J Radiat Oncol Biol Phys* 1992;22:199–212.

To cite: McGowan DR, Macpherson RE, Bradley KM, *et al*. *Thorax* 2016;**71**:97.

Thorax: first published as 10.1136/thoraxjnl-2015-207400 on 8 September 2015. Downloaded from http://thorax.bmj.com/ on April 10, 2024 by guest. Protected by copyright.