The Lancet Oncology: New MRI technique could offer radiation-free alternative for visualising cancerous tumours in children

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A new type of whole-body magnetic resonance imaging (MRI) test could be an alternative to standard positron emission tomography/computed tomography (PET/CT) imaging for assessing cancer in children and young adults, but without exposure to radiation that has been shown to increase the risk of secondary cancers in later life.

In The Lancet Oncology, a research team from the Stanford University School of Medicine reports that the new scanning technique, which uses an iron supplement (ferumoxytol) to enhance tumour visibility, appears to be just as effective as PET/CT imaging with comparable sensitivities, specificities, and diagnostic accuracy.

"Although our initial results need to be confirmed in larger groups of patients, in our study whole-body MRI performed well enough to be immediately clinically applicable and could relieve young patients from the risks of radiation exposure due to medical imaging"*, says Dr Heike Daldrup-Link, who led the research.

CT and 18F-fludeoxyglucose (18F-FDG) PET/CT scans are the main tests for assessing the extent of disease (staging) and to determine treatment planning and prognosis. Use of this technology has increased rapidly over the past several years and the potential cancer risks are well established, especially in children, who are more radiosensitive than adults and live long enough to encounter secondary cancers.

"Even with child-adapted low-dose protocols, patients undergoing a single 18F-FDG PET/CT scan are typically exposed to ionising radiation equivalent to roughly 700-750 chest radiographs (10-20 mSv) and four times the yearly background dose from natural radiation"*, explains Daldrup-Link.

Ionising radiation in early childhood has been shown to roughly triple the risk of lifetime cancer compared with a person exposed over the age of 30 years, whilst cumulative exposure from diagnostic CT scans has been found to nearly triple the risk of developing secondary leukaemia and brain cancer in later in life.

In this study, the researchers compared the diagnostic accuracy of standard 18F-FDG PET/CT with an approach based on whole-body diffusion-weighted MRI combined with the iron supplement ferumoxytol, used "off label" as a contrast agent. Ferumoxytol is composed of ultra small superparamagnetic iron oxide particles which can be detected with MRI.

They scanned 22 children and young adults with malignant lymphomas and sarcomas using both whole-body MRI and 18F-FDG PET/CT and found much the same sensitivities (93.7% vs 90.8%), specificities (97.7% vs 99.5%), and diagnostic accuracy (97.2% vs 98.3%).

Average exposure to ionising radiation was 12.5 mSv for 18F-FDG PET/CT compared with zero for whole-body MRI. No adverse reactions associated with ferumoxytol were recorded.

According to Daldrup-Link, "The unique properties of iron oxide particles have overcome some of the major limitations of whole-body diffusion-weighted MRI that have prevented its use for tumour staging in

clinical practice. These include long-lasting enhancement (ferumoxytol can enhance vessels for more than 24 hours) and the ability to visualise tumours in the spleen and bone marrow that may have previously have gone unnoticed."*

The authors conclude by pointing out that the new technique does not need specific equipment and could be easily used on different MRI scanners for roughly the same cost as an 18F-FDG PET/CT examination.

Writing in a linked Comment, Thomas Kwee from the University Medical Centre Utrecht in The Netherlands says, "Although the technical feasibility and potential diagnostic value of using ultrasmall superparamagnetic iron oxide particles in a whole-body diffusion-weighted MRI protocol has been shown in these patients, further work is needed before it can become a clinical alternative to 18F-FDG-PET/CT."

*Quotes direct from author and cannot be found in text of Article.

See full article at http://www.thelancet.com/journals/lanonc/article/PIIS1470-2045(14)70021-X/abstract