New imaging process provides better picture of tumours

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Cancer remains one of the leading causes of death in Europe and the world, and early detection and treatment remains vital in the fight. Researchers in Norway have validated a method of non-invasive imaging that they believe will aid in the identification of aggressive tumours. Their breakthrough provides valuable information about interstitial fluid pressure (IFP) of solid tumours, and their results have been published in *Cancer Research*.

In the European Union, the long-term aim is the primary prevention of cancer. EU Health Ministers have adopted recommendations for best practice in the early detection of cancer. Regular and systematic examinations can detect the disease early, when it is more responsive to less aggressive treatment. Once detected, the appropriate treatment can be prescribed. It has been shown that these examinations can significantly reduce cancer mortality and improve the quality of life of cancer patients.

The researchers based their research on IFP, which many malignant solid tumours generally develop a higher amount compared to normal tissue. Interstitial fluid, also known as tissue fluid, is the solution surrounding our cells. It provides our cells with nutrition as well as a means of waste disposal.

An average person has approximately 11 litres of this fluid in their body. In tumours however, high pressure is created and this may cause a reduced uptake of chemotherapeutic agents and resistance to radiation

therapy. In addition, a high IFP has been found to promote metastatic spread, which is when the cancer 'migrates' to another location in the body.

'Currently, an imaging method for non-invasive assessment of the IFP of tumours is needed to evaluate the potential of IFP as a biomarker for cancer aggressiveness and, hence, to identify patients with cancer who may benefit from particularly aggressive treatment because of highly elevated tumour IFP,' said Einar K. Rofstad, Ph.D., of the department of radiation biology at the Institute for Cancer Research, Norwegian Radium Hospital, Oslo, Norway.

What Rofstad and colleagues did was to test the use of dynamic contrast-enhanced magnetic resonance imaging (MRI) to evaluate the velocity of fluid flow from tumours in human cell lines of cervical carcinoma and melanoma implanted in mice. The researchers had hypothesised that the velocity of fluid flow from tumour tissue into adjacent tissue was determined by the IFP drop at the tumour surface.

Their results indicated that the velocity of the fluid flow at the tumour surface strongly correlated with the magnitude of the tumour IFP, and that dynamic contrast-enhanced MRI with gadolinium diethylene-triamine penta-acetic acid (Gd-DTPA) as a contrast agent can be used to noninvasively measure the fluid-flow velocity.

In addition, primary tumours of mice with metastases had a significantly higher IFP and fluid-flow velocity at the tumour surface compared with the primary tumours of metastasis-free mice, confirming that the development of lymph node metastases strongly correlated to the IFP of the primary tumour and the velocity of fluid flow as measured by Gd-DTPA-based dynamic contrast-enhanced MRI.

'Our findings establish that Gd-DTPA-based dynamic contrast-enhanced

MRI can noninvasively visualise tumour IFP,' Rofstad said. 'This reveals the potential for the fluid-flow velocity at the tumour surface determined by this imaging method to serve as a novel general biomarker of tumour aggressiveness.'

Rofstad went on to add that comprehensive prospective clinical investigations in several types of cancer are needed to assess the value of fluid-flow velocity at the tumour surface level as a general biomarker for interstitial hypertension-induced cancer aggressiveness.

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