

4 D BIOLOGICAL IMAGING OF HYPOXIA IN HUMAN TUMOURS

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Background:

Solid tumours contain varying degrees of hypoxia. Studies show hypoxia to be associated with poor local control and survival, as hypoxia is a cause of resistance to radio- and chemotherapy and the development of a more aggressive tumour.

Previous attempts to measure hypoxia have been biased because the techniques have been invasive, not repeatable or difficult to apply on a routine basis. There is great interest in trying to measure hypoxia in tumours as this could lead to individualized hypoxia-modifying therapy and prediction of treatment response. Additionally our knowledge of change in hypoxia over time is limited, but of great interest as individualised treatment, such as IMRT is emerging.

¹⁸F-FAZA, a new hypoxic marker, appears promising. It is a nitroimidazole, which gets trapped in hypoxic cells and can be detected by a PET scan. Compared to other nitroimidazoles, ¹⁸F-FAZA has superior biokinetics and thereby is believed to provide a faster and clearer image of hypoxia.

Materials and methods:

1. A correlation study; patients with operable squamous cell carcinoma (SCC) will receive an ¹⁸F-FAZA PET/CT scan prior to surgery. Following staining with pimonidazole (a well established hypoxia marker) the surgical specimen will be correlated to the scan and ¹⁸F-FAZA autoradiography, to find the association between volumes defined by functional imaging and 3D pathoanatomical morphology. The objective is to examine ¹⁸F-FAZA PET/CT scan as a marker of hypoxia
2. A prognostic and a time study: patients with SCC requiring radiation will receive ¹⁸F-FAZA PET/CT scans prior to treatment and the scan will be correlated with outcome. Some patients will also receive a scan every 2 weeks during their treatment and once following radiation. The objective is to examine the change of hypoxia over time during radiation.

The project will be carried out at the Department of Exp. Clinical Oncology, which has many years of experience in pre-clinical and clinical hypoxia research.

Perspectives:

Establishing ¹⁸F-FAZA PET/CT scan as a superior hypoxia marker is essential as this could lead to integrating biological information in radiotherapy treatment planning with the aim of targeting radiation resistant regions also known as dose painting.