

Individualized chemo-radiation therapy based on quantitative functional imaging

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Functional imaging provides non-invasive quantitative information about biological and physiological processes of relevance for the response to treatment, and may as such be critical for the development of individualized cancer therapy. PET-imaging - with appropriate tracers - enables visualization of the tumor energy metabolism, cellular proliferation, apoptosis, angiogenesis, hypoxia as well as receptor status, whereas tracer kinetics can be quantified from 4D PET imaging. Dynamic contrast enhanced (dce) MR imaging can be utilized in deriving voxel-wise information about e.g. blood perfusion of the tumor as well as information about the extra-cellular space. Tumor hypoxia has been shown to correlate to quantitative dce-MR images. Based in diffusion weighted MR imaging, the apparent diffusion of water molecules can be measured and information about cellular integrity of tumor tissue can be derived. MR spectroscopy provides quantitative information about various metabolites in the tumor tissue.

Vast amount of information about biological features that - directly or indirectly - are of importance for the response to therapy requires advanced mathematical tools in the search for complex mechanism and relationships. Artificial neural networks (ANN) is one example of such strategies that can be utilize in computer assisted clinical decision -making. ANN analysis of various quantitative MR parameters have e.g. shown to be able to predict response to chemo-irradiation in pre-clinical tumor models.

Quantitative functional imaging provides information about tumor biological features in addition to that of genomics and proteomics, and should be integrated into a cancer systems biological approach towards individualized cancer therapy.

Biography

Dag Rune Olsen holds a Ph.D in biomedical physics, University of Oslo. He has been department head/head of research at the Institute of Cancer Research, The Norwegian Radium Hospital, Oslo, and professor of biomedical physics, University of Oslo. Professor Olsen is now Dean of Science at the University of Bergen. He has published more than 100 papers in international peer-review journals. Olsen is member of editorial boards and international advisory boards of international scientific journals as well as member of the board of the European Society of Therapeutic Radiology and Oncology. He is the recipient of the 2008 Klaas Breur Award.