

AbstractID: 7827 Title: PET for chemo/radiation therapy response assessment

The most commonly used method to assess treatment response relies on measuring tumor sizes before and after treatment and classifying tumor anatomical shrinkage according to RECIST or WHO criteria. However, there is a considerable variability between individual studies and the same response rate can be associated with completely different survival rates. Furthermore, it is known that changes in tumor biological function significantly precede gross anatomical tumor changes. Positron emission tomography (PET) is the most sensitive, specific and versatile imaging modality that can be used for this purpose.

¹⁸F-Fluoro-deoxyglucose (FDG) is the most commonly used PET imaging agent for treatment assessment. FDG shows regions of active glucose metabolism, which are typically decreased after tumor cells die in response to antineoplastic therapies. Besides FDG, several other PET agents exist, which are more specific in cell targeting, and can image different aspects of biological response to therapy. Cell proliferation, apoptosis and angiogenesis are processes that are typically affected by antineoplastic therapies. Currently, the most promising non-FDG agent is ¹⁸F-Fluorodeoxythymidine (FLT) as a marker of cell proliferation. PET imaging agents of apoptosis and angiogenesis are still mostly limited to preclinical studies. Use of PET imaging for treatment assessment imposes special requirements on image acquisition, reconstruction and analysis.

FDG-PET has shown an extreme promise to assess treatment efficacy, both after, as well as during the course of therapy. Depending on the metabolic response, it is possible to classify patients into metabolic responders, which have typically much longer survival rates than metabolic non-responders. Unfortunately, FDG is not without problems. Two of the most severe are (1) radiation-induced inflammation during radiation therapy and (2) metabolic flare that occurs early after the start of some chemotherapies. FLT-PET, which assesses proliferative response, seems to overcome these problems; however, more clinical studies are needed to prove its wider applicability. Reproducible and accurate PET image acquisition, reconstruction and analysis are the key components required for quantitative PET imaging, which provides foundation for treatment assessment.

This symposium reviews the status of treatment assessment studies that involve repeat PET imaging during and after therapy. It discusses advantages and disadvantages of FDG and non-FDG-PET imaging for treatment assessment. It also emphasizes importance of the appropriate PET imaging acquisition, reconstruction and analysis that forms the basis for PET image quantification.

Educational Objectives:

1. Overview of FDG-PET imaging for treatment assessment
2. Overview of non-FDG-PET imaging for treatment assessment
3. Review PET image acquisition, reconstruction and analysis for treatment assessment
4. Discuss future of PET imaging for treatment assessment