Intra tumor heterogeneity as biomarker of response to treatment : Prospective evaluation by Parametric Response Mapping (PRM) applied in MRI volumetric images of breast cancer.

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Abstract

The Parametric Response Mapping (PRM) is a new method of evaluation of patient's response to chemotherapy by measuring changes of quantitative MRI values of underlying tumor tissues by using a voxel-by-voxel approach. In that way spatial alterations after treatment initiation are depicted. This is a fundamentally distinct approach from the volume of interest (VOI) method where the sum of the whole volume before and after treatment are compared.

Voxel-by-voxel comparison of MRI parametric maps is performed by co-registration of pretreatment and post treatment images acquired at short time intervals after treatment initiation in an effort to provide not only early assessment of treatment outcome but also information of intratumoral heterogeneity [1].

The PRM technique has not been widely used for breast cancer. However, it has been occasionally exploited on brain cancer, where the technique has proven its efficiency [2(36), 3(37), 4(38)]. For example A. Moffat et al. [4(38)] used DCE-MRI for 20 patients with primary brain tumors. All MR images were in this study spatially co-registered by using the pretreatment images as the reference dataset. This step allowed all images of a given patient to be viewed and analyzed from a fixed frame of reference. The co-registration was performed by using mutual information for automatic multi-modality image fusion after this co-registration. For each patient, diffusion changes were quantified by using a multi-parametric analysis.

For breast cancer The PRM application has been achieved by Jennifer L. Boes et al. In 2014 [5(31)], in this study they used a new approach for co-registration between images before and post treatment, to evaluate the response to treatment, using MRI diffusion images data of 52 patients.

In our institutions of J. Bordet and UMONS, we are performing a prospective study including 50 adult patients with a breast tumor requiring a neoadjuvant treatment before planned surgery. The main objective of our study is to evaluate the intratumoral heterogeneity before and after treatment, and also heterogeneity of response after the first cycle of neoadjuvant chemotherapy. The tumor heterogeneity will be quantified and results will be compared with the standard radiological tumor response assessed according to RECIST criteria (Measurement of maximum diameter) and with pathological response at the time of surgery.

We are aiming to facilitate the early detection of non responders patients to chemotherapy therefore unnecessary toxic chemotherapy treatment will avoided and to offer a new biomarker of response to the oncologists.

References

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