Assessment of tumor microcirculation in rectum carcinoma with regard to different pharmacokinetic models, intra- tumor heterogeneity and therapeutic effects after neoadjuvant radio-chemotherapy

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Purpose: Measurement of changes in DCE- MRI parameters of rectum carcinoma patients before and after neoadjuvant radio- chemotherapy using two slices per patient and measurement to compare the assessed results of different models (Brix/Tofts) between each other and the different slices.

Methods and Materials: DCE- MRI measurements of 30 patients with rectum carcinoma were performed on a 1.5 T MR system (TurboFLASH, FoV: 350mm, Matrix: 256x192, Slice: 7mm, TR/TE/TI: 7,0/3,86/120ms, Flip angle 12°, 200 Hz/px Bandwith, Voxel size 1,37x1,37x7mm³) during intravenous contrast media application before and after neoadjuvant radio- chemotherapy. For each measurement two slices were applied in maximal tumor extent. The resultant images were analyzed semi-quantitatively and quantitatively (Brix and Tofts compartment models).

Results: Significant changes were found for several parameters including the semi-quantitative *time to peak* (TTP, p<0,001) and the quantitative values k_{ep} from the Brix model (p<0,001), *K* from the Tofts model (p<0,001) and *AuCtP* (area under the curve till maximum enhancement, p<0,001). The percentage decrease in exchange rate parameters of the applied pharmacokinetic models was similar (both k_{ep} and *K* decreased about 50%). The two slices applied in maximal tumor extent showed no significant different results.

Conclusion: Neoadjuvant radio-chemotherapy results in a significant change of tumor microcirculation. Neither the slice selection in the maximal tumor extent affected the results in later analysis nor was it possible to find a relevant difference in therapeutic effects between the corresponding parameters of the pharmacokinetic models.