

**Interobserver Agreement of Semi-automated, Volumetric Analysis of multiparametric MRI in Patients with Liver Cancer**  
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**TARGET AUDIENCE** - Clinical researchers and radiologists

**Purpose of Study** A reliable measure of response to treatment is important for clinical practice and for clinical trials in oncology. The purpose of our study was to assess the interobserver agreement of two semi-automated methods and a manual approach measuring the following functional, volumetric and morphologic parameters: 1) apparent diffusion coefficient (ADC), 2) venous enhancement (VE), 3) maximal tumor diameter, 4) tumor volume, 5) RECIST, and 6) EASL in 50 patients with Hepatocellular Carcinoma (HCC) before and 1 month after intra-arterial therapy (IAT).

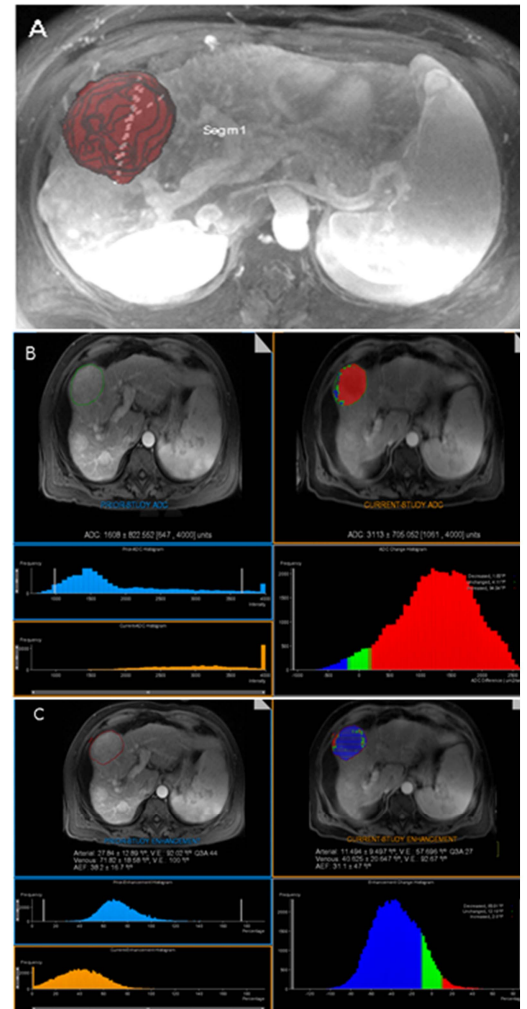
**Materials, Methods and Procedures:** This HIPAA-compliant retrospective study had institutional review board approval. The requirement for patient informed consent was waived. Tumor size, ADC and VE in 50 patients with HCC was measured using two semi-automated, volumetric methods and a manual method. Observer agreement was evaluated using the Intraclass Correlation Coefficient (ICC).  $P < 0.05$  was considered to indicate a significant difference.

**Results:** Semi-automated volumetric measurements of tumor size before and after IAT had better interobserver agreement (ICC=0.886–0.996) compared with manual size measurements (ICC=0.543–0.809). Volumetric measurements of functional parameters (ADC and VE) before and after IAT also had better interobserver agreement (ICC=0.864–0.971) compared with manual ROI measurements (ICC=0.536 – 0.799). The interobserver agreement for change in tumor size was also higher using volumetric measurements (ICC=0.627–0.854) compared with manual measurements (ICC=0.169–0.653). Similarly, the interobserver agreement for change in tumor ADC or VE was higher using volumetric measurements (ICC=0.830) compared with manual measurements (ICC =0.158–0.648). Among all manual measurements, interobserver agreement for the manual assessment of EASL was the best (ICC=0.653 for change in EASL).

**Discussion:** As hypothesized, the semi-automated analysis of functional and morphologic MRI metrics resulted in a higher interobserver agreement compared with the manual approach. Morphologic, size measurements showed a lower interobserver agreement overall, while functional parameters (ADC and enhancement) showed a high agreement when semi-automated methods were applied but low agreement when measured manually. Change in EASL size measured manually was the exception to this finding. EASL displayed a fairly high interobserver agreement. This confirms results of prior studies <sup>1, 2</sup>. However, EASL cannot always be assessed and, indeed, could not be determined in 7 subjects in our study, and, furthermore, the correct method used to evaluate viable tumor tissue is a matter of debate; and is sometimes measured as percent enhancement, and, on other occasions, as the cross-product of length and width of the tumor area.

**Conclusion:** Semi automated, volumetric measurements of HCC morphology and function before and after IAT show a very good interobserver agreement. The evaluation of functional changes assessed by ADC and VE based on whole-lesion segmentation demonstrated better reproducibility than ROI measurements or any size measurements.

**References** : 1. Galizia, M. S. *et al. Acad. Radiol.* **19**, 48-54 (2012). 2. Duke, E. *et al.. J. Vasc. Interv. Radiol.* **21**, 515-521 (2010).



Example of the semi-automated, volumetric, co-registered MRI data analysis. **(A)** Segmentation of the HCC index lesion based on co-registered images. **(B)** Analysis of the tumor pre- and 1 month post-treatment ADC **(C)** Volumetric venous enhancement (VE) measurements.