In Vivo Assessment of Non-Small Cell Lung Cancer: Detection of Early Response to Concurrent Chemoradiotherapy by Using T1 Based Dynamic Contrast Enhanced MRI

Xiuli Tao[1], Han Ouyang[1], Li Liu[1], Feng Ye[1], Ying Song[1], Zihua Su[2], Xiao Xu[2], and Ning Wu[1]
[1]*Department of Diagnostic Radiology, Cancer Hospital Chinese Academy of Medical Sciences, Beijinh, Beijing, China,* [2]*GE Healthcare, Beijing, China*

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Target Audience This work targets those, who are interested in monitoring lung cancer treatment response by dynamic contrast-enhanced (DCE) MRI.

Purpose To investigate the capability of using T1 based DCE-MRI perfusion parameters to monitor response to concurrent chemoradiotherapy (CCRT) in patients with non-small cell lung cancer (NSCLC).

Introduction DSC-MRI has been extensively used in monitoring treatment response on brain. However, DSC was not able to be performed in body anatomy such as lung. In this paper, we demonstrated by using T1 perfusion on lung, de-convolution based method can extract meaningful parameters to monitor concurrent chemoradiotherapy (CCRT) response of patients with non-small cell lung cancer (NSCLC).

Methods A total of 24 patients with stage IIIA or IIIB NSCLC, who underwent MRI perfusion before CCRT, 2 weeks after starting therapy (total dose of 20 Gy) and at the end of therapy (total dose of 60 Gy), were enrolled. Consent forms were obtained prior to studies. A pre-contrast T1 phase and a dynamic phase after contrast were obtained on a 3.0T (Signa Excite HD, Medical System, USA) scanner. Regions of interests (ROI) were placed on the regions, where the largest area of tumor was observed. Perfusion parameters (BF, BV, MTT) were calculated by a de-convolution method. Tumor perfusion parameters and percentage change in these parameters were compared between responders versus non-responders using the Mann-Whitney test.

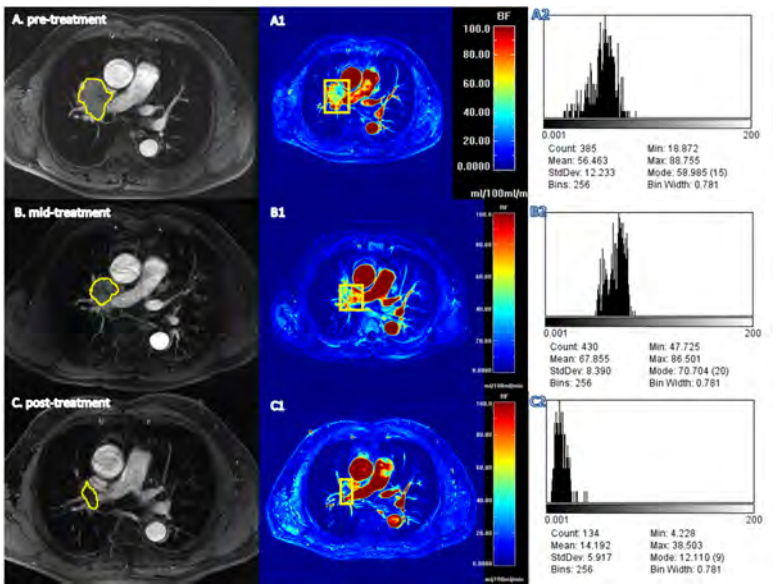

Fig. 1 A 61-year-old man with non–small cell lung cancer, who had a good response of concurrent chemoradiotherapy was shown. A. before therapy (pre-treatment), B. 2 weeks after therapy (mid-treatment) and C. at the end of therapy (post-treatment). Axial color-coded BF maps of DCE-MRI at pre-treatment (A1), mid-treatment (B1), and post-treatment (C1). Histogram was shown on A2, B2 and C2, respectively.

The treatment response after CCRT was assessed with Revised Response Evaluation Criteria in Solid Tumors (RECIST1.1), and then the relationship between quantitative parameters and early tumor response to CCRT was evaluated by Spearmen's correlation analysis.

Result All quantitative parameters showed significant changes in response to CCRT (P<0.05). Mean tumor BF increased from 34.3ml/100g/min at baseline (pre-treatment) to 42.3ml/100g/min at week two (P<0.001) and decreased to 16.3ml/100g/min at the end of CCRT (P<0.001). BF was lower in responders versus non-responders at the end of CCRT (11.3 ml/100g/min versus 46 ml/100g/min, P=0.01). The decreased percentage of BF between baseline and the end of CCRT was significantly correlated with tumor regression rate (P=0.01).

Conclusion MRI perfusion parameters were seen to be a viable tool to monitor early response to or predict prognosis after CCRT of NSCLC. Within all three parameters, BF seemed to convey more meaningful information than others.