

Usefulness of Pseudo Continuous Arterial Spin Labeling for Head and Neck Squamous Cell Carcinoma

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Purpose

Arterial spin-labeling (ASL) techniques have been widely used for the quantitative assessment of tissue perfusion [1], of which pseudo-continuous ASL (pCASL) is considered useful due to its higher signal to noise ratio (SNR). For the assessment of head and neck squamous cell carcinoma (HNSCC), measurement of tumor blood flow (TBF) is important as a functional evaluation of tumor viability and treatment effect. MR dynamic contrast enhanced (DCE) [2] or dynamic susceptibility contrast (DSC) [3] method to evaluate TBF in HNSCC was reported previously, but there is no report which evaluates TBF in HNSCC using pCASL. The aim of this study was to evaluate feasibility of the pCASL in HNSCC for noninvasive measurement of TBF by assessing its usefulness as prognostic factor and monitoring tool of treatment effect of non-surgical treatment.

Methods

Twenty five consecutive patients with HNSCC underwent pCASL by using a 3.0-Tesla unit (Achieva TX; Philips Medical Systems, Bests, the Netherlands) with a 16-channel neurovascular coil. Parameters of pCASL were as follows; TR 3554 ms, TE 14 ms, labeling duration 1650 ms, post labeled delay 1280 ms, background suppression 60 and 1110 ms after labeling, FOV 24 × 24 cm, matrix 80 × 80, slice thickness 5 mm × 15slices, readout; multishot spin-echo echo-planar imaging, scan time 5'05. TBF was quantitatively calculated in each tumor. Anatomical images were also acquired using axial T2WI and T1WI. By using these anatomical images, tumor volume (TV) was quantitatively measured manually. All patients were treated by super-selective arterial infusion of cisplatin with concomitant radiotherapy (total 65 Gy). MR scanning was performed before treatment and at early treatment period (time point of 15~22 Gy in 65 Gy). After the treatment, multi-modality assessment by using FDG-PET, CT, MRI and short term follow-up (three months) were performed to determine treatment responders (CR) or non-responders (non-CR). Statistical analysis was performed to compare TBF and TV of each time period between CR and non-CR. Percent decrease in TBF and TV between the two time periods were also compared.

Results

After the treatment, twenty two patients were determined as CRs and three patients non-CRs. Pre-treatment TBF of non-CRs (96.5 ± 9.8 ml/100g/min) was significantly lower than that of CRs (185.4 ± 53.1 ml/100g/min). TBF values of early treatment period did not vary significantly between CRs and non-CRs, but percent decrease in TBF was significantly lower in non-CRs (13 ± 5 %) than in CRs (36 ± 17 %). On the other hand, both TV and its percent decrease did not vary different significantly between CRs and non-CRs (Fig.1) (Fig.2).

Discussion

In this study, TBF in HNSCC was successfully measured by using pCASL. Pre-treatment TBF and percent decrease in TBF at early treatment period were suggested as prognostic factors to determine treatment response. Moreover, TBF and its percent decrease are considered as more sensitive indicator to determine treatment effect than TV and its percent decrease. A pCASL, being completely non-invasive, can be easily performed for evaluation of the TBF at early treatment period without concern on patient's renal dysfunctions commonly among patients with treatment of cisplatin, a condition in which contrast media should be avoided.

Conclusion

Non-invasive assessment of TBF by pCASL can be useful for estimation of prognosis and early detection of treatment effect.

References

[1] Detra et al., J Magn Reson Imaging. 35(5): 1026-37 (2012); [2] Chikui et al., J Magn Reson Imaging. 36(3): 589-97 (2012); [3] Razek et al., Eur J Radiol. 77(1): 73-9 (2011)

