

Impact of T1 Mapping on Quantitative Analysis of Dynamic Contrast Enhanced MRI of Head and Neck Tumors

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Purpose:

Dynamic contrast-enhanced (DCE) MR imaging has the potential to assess tumor microvascular environment and evaluate response to anti-angiogenesis treatment for head and neck cancers. However, the technique of DCE MRI for head and neck cancer lacks standardization. Many previous reports were conducted without measurements of native T1 (T10 map) values. The purpose of this study is to evaluate the impact of T1 mapping on the quantitative assessment of DCE parameters.

Materials and Methods:

Among 22 patients who underwent DCE MRI, 13 patients had variable flip angle T1 mapping included in their study. Three patients were excluded from the analysis due to technical reasons (coverage of T10 map was different from the DCE MRI sequence). Seven patients had a measurable tumor visible on DCE MRI. Regions of interest (ROIs) were placed manually over these tumors. In the absence of visible tumor, normal muscle was evaluated. Dynamic contrast-enhanced MRI was analyzed using the extended Toft's model (Olea Medical, Sphere 3.0). Dynamic contrast-enhanced MRI parameters, Ktrans (volume transfer constant between plasma and extravascular, extracellular space, EES), Kep (rate transfer constant between EES to plasma), and Ve (extravascular, extracellular volume) were measured both with and without T1 maps. Intraclass correlation coefficient was performed to address the degree of agreement.

Results:

The average ratio of variables without T1 map to with T1 map was: 2.95 +/- 2.8 for Ktrans, 2.47 +/- 2.4 for Kep, and 2.04 +/- 1.66 for Ve. The intraclass correlation coefficient for Ktrans, Kep and Ve respectively was: -0.104 (-0.665, 0.531), 0.775 (0.324, 0.939) and -0.294 (-0.781, 0.413).

Conclusions:

Dynamic contrast-enhanced parameters were overestimated by approximately 2-3 times without measurement

of native T1 values (see Figure 1). There was no intraclass correlation between either approach for Ktrans and Ve with a moderate correlation for Kep. In order to use quantitative values for clinical decision-making, it is essential to perform accurate T1 measurements.

Awards:

Dyke Award
Trainee Award

Categories:

HEAD AND NECK, New Techniques

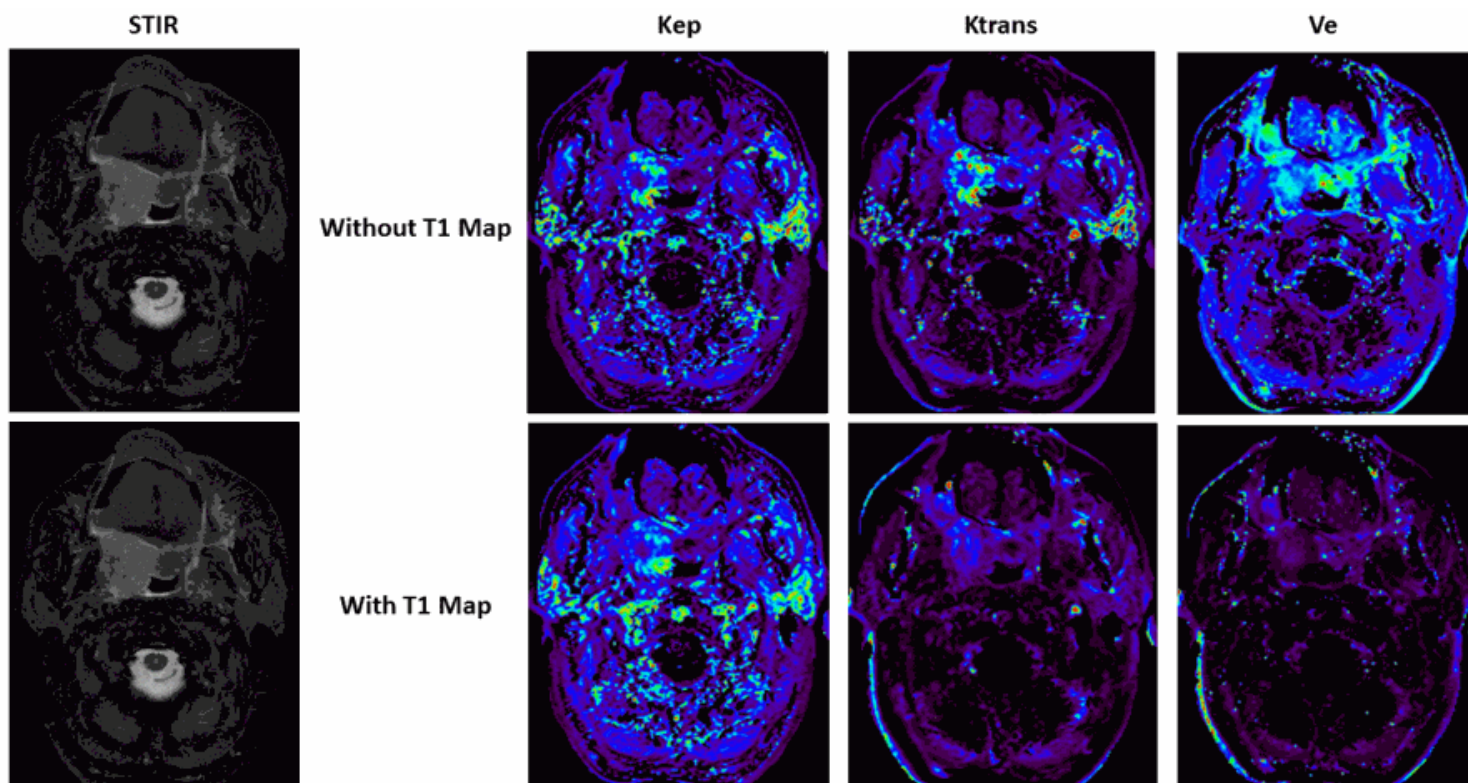


Fig 1. DCE MRI images without T1 mapping demonstrating increased signal and overestimation of kinetic parameters of a right tonsillar SCC compared to images with T1 mapping

(https://ww4.aievolution.com/asn1501/files/content/abstracts/abs_2583/DCE.gif)

Reference One:

Tofts PS, Berkowitz B, Schnall MD. Quantitative Analysis of Dynamic Gd-DTPA Enhancement in Breast Tumors Using a Permeability Model. *MRM* 1995; 33: 564-568

Reference Two:

Yuan J, Chow SK, Yeung DK, et al. Quantitative evaluation of dual-flip-angle T1 mapping on DCE-MRI kinetic parameter estimation in head and neck. *Quant Imaging Med Surg* 2012; 2(4): 245-253.

Reference Three:

Chawla S, Kim S, Loevner LA, et al. Prediction of Disease-Free Survival in Patients with Squamous Cell Carcinomas of the Head and Neck Using Dynamic Contrast-Enhanced MR Imaging. *AJNR Am J Neuroradiol* 2011; 32: 778-784.

