Lower Baseline Apparent Diffusion Coefficient Values Associated with Poor Prognosis in Locally Advanced Pancreatic Cancer

Anna M Laucis, MD, MPhil,[1] Yilun Sun, PhD,[1,2] Yue Cao, PhD,[1] Theodore S Lawrence, MD, PhD,[1] Mahmoud Al-Hawary, MD,[3] Thomas Chenevert, PhD,[3] Kyle C Cuneo, MD[1]

[1]*Department of Radiation Oncology, University of Michigan, Ann Arbor, MI*
[2]*Department of Biostatistics, University of Michigan, Ann Arbor, MI*
[3]*Department of Radiology, University of Michigan, Ann Arbor, MI*

Abstract

Introduction: A challenge in locally advanced pancreatic cancer is the difficulty in obtaining adequate tumor tissue to personalize therapy. Non-invasive diffusion magnetic resonance imaging (dMRI) has the potential to tell us about the biology of a tumor and its responsiveness to therapy. Our prior work found a significant association between pretreatment apparent diffusion coefficient (ADC) and pathological response in patients with resectable pancreatic cancer undergoing preoperative chemoradiation. The goal of the current study was to prospectively investigate the relationship between dMRI characteristics and outcomes after chemoradiation in locally advanced pancreatic cancer patients.

Methods: Patients with locally advanced pancreatic cancer were prospectively enrolled onto an IRB-approved clinical trial investigating dMRI characteristics at multiple time points before and during chemoradiation. Each pancreatic tumor was delineated by two radiation oncologists on T1-weighted MRI and dMRI images. Baseline and mid-treatment ADC values were then analyzed and compared to clinical outcomes including time to local failure (TTLF), time to distant failure (TTDF), progression free survival (PFS), and overall survival (OS). Additionally, CA-19-9 values were obtained for each patient pre-radiation and at four months post-radiation and compared with clinical outcomes. Univariable Cox proportional hazard models, Student's t-tests, and Kaplan Meier methods were used for statistical analysis.

Results: A total of 23 MRI scans were obtained in nine patients receiving gemcitabine-based chemoradiation. There were six male and three female patients, with median age of 64 years (range 52-73). The median PFS was 18 months and median OS was 25.3 months from diagnosis for the cohort. Pre-treatment baseline MRIs were obtained a median of 25 days (range 1 – 35) prior to radiation. We found a significant association between lower baseline ADC values and several clinical outcomes. Specifically, lower mean baseline tumor ADC values were associated with lower OS, lower PFS, shorter TTLF, and shorter TTDF. In contrast, there was no significant relationship between CA-19-9 lab values or mid-treatment ADC with any clinical outcome.

Conclusions: Lower baseline tumor ADC values were found to significantly correlate with clinical outcomes including worse survival in locally advanced pancreatic cancer patients. This is concordant with prior studies showing poor pathological responses in resectable pancreatic cancer patients with lower baseline ADC values, and further investigation is needed to study how this non-invasive imaging biomarker may help with clinical decision-making and treatment planning.