Longitudinal change of T2 map during MR-guided SBRT for pancreatic cancer

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JULY 12–16 2020 VIRTUAL JOINT AAPM | COMP MEETING
EASTERN TIME [GMT-4]

INTRODUCTION

Both anatomic and functional MRIs are being acquired in each fraction during MR-guided adaptive radiation therapy (MRgART) on 1.5T MR-Linac. These longitudinal functional MRIs (e.g., T2 map) may provide patient specific treatment response data that may potentially be used for response guided adaptive treatments

AIM

In this study, we investigate if there is consistent change in delta-radiomic features [1-2] of the daily T2 map collected during MRgART/SBRT for pancreatic cancer.

METHOD

Daily T2 maps for five pancreatic cancer (3 pancreatic head and 2 pancreatic body) patients treated on a 1.5T MR-Linac were included in this initial study (see **Table 1**). These patients were treated with 5-fraction SBRT with prescription doses ranging from 30 Gy to 35 Gy. The gross tumor volumes (GTV) were delineated by treating physician during the online adaptation in every fraction.

The T2-maps (See **Figure 1**) were preprocessed prior to radiomic feature extraction. Preprocessing involved bias correction, denoising with a gaussian filter and histogram equalization.

Radiomic features were extracted with IBEX[3] (imaging biomarker explorer) software package. Radiomics features that were found independent of motion[4] were obtained in each fraction from the segmented GTVs. Change of a variety of radiomic feature (delta radiomics) in the target on the T2 maps were examined to determine those with trend repeatedly among different patients.

Table 1. Summary of patients treatment fractionation.

ID	Tumor Site	Total dose (cGy)	Fraction (#)
P1	Pancreas head	3500	5
P2	Pancreas Head	3500	5
P3	Pancreas Body	3300	5
P4	Pancreas Head	3300	5
P5	Pancreas Body	3000	5

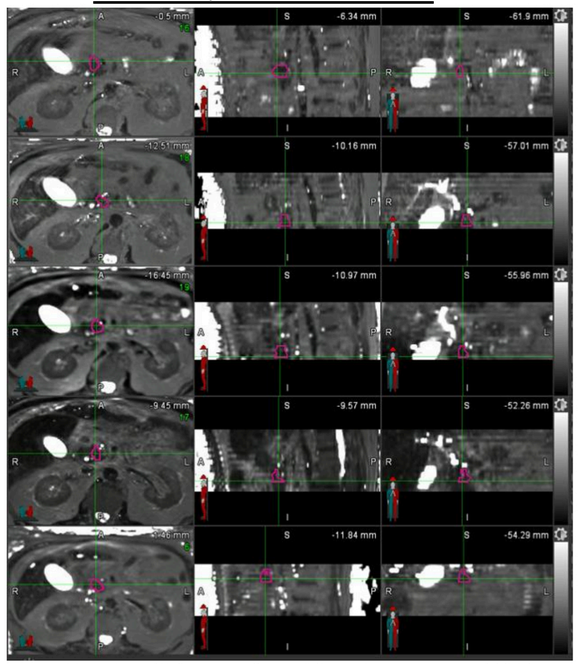

Figure 1. A series of T2 maps for a 5 fraction pancreas SBRT

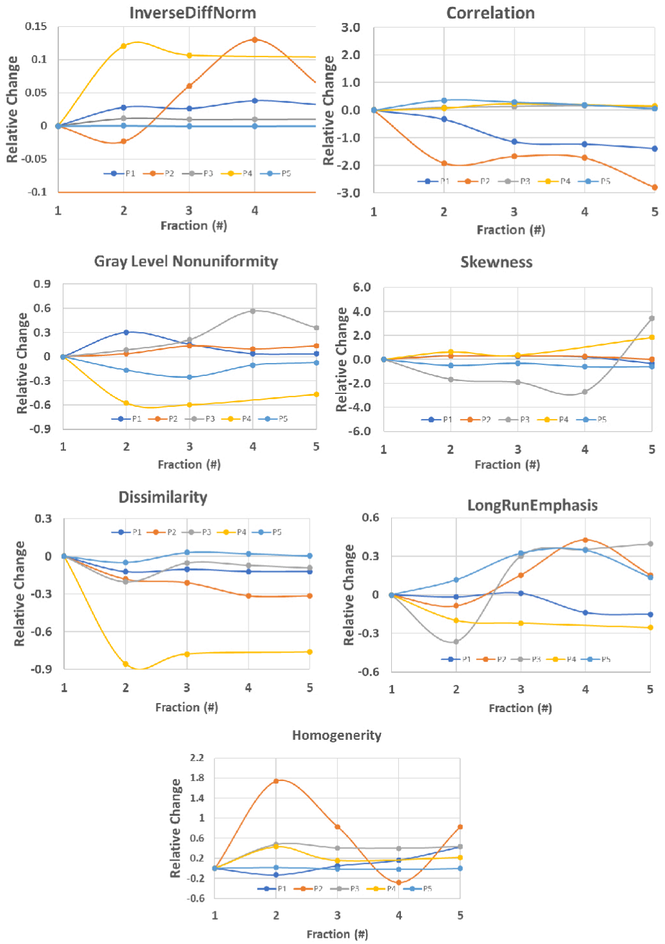

Figure 2. Seven Radiomics features changes from the first fraction (The trends can be different for some features for the head and body of pancreas)

RESULT

1. Three different matrices (**Intensity Histogram, Gray Level Cooccurence Matrix 25, and Gray Level Run Length Matrix 25**) were used in data analysis
2. Seven radiomic features (**inverse difference normalized, Correlation, gray level non uniformity, skewness, dissimilarity, long run emphasis, homogeneity**) showed consistent longitudinal trends (**See Figure 2**).
3. The trends of some features might be different for pancreas head and body. For example, **Inverse Difference normalized**, **Correlation**, **Dissimilarity.**

CONCLUSIONS

Longitudinal consistent changes of radiomic metrics in the preliminary study of daily T2 maps were observed during the short course of MR-guided SBRT for pancreatic cancer. Several potential Delta Radiomics features were identified. The initial results need statistical validation. With further studies based on larger datasets and more sophisticated statistical analysis, the daily T2 maps may be developed as an image biomarker for response-guided adaptive radiation treatment.

REFERENCES

[1] H Nasief, C Zheng, D Schott, W Hall, S Tsai, B Erickson, XA Li. *A machine learning based delta-radiomics process for early prediction of treatment response of pancreatic cancer* **NPJ precision oncology 3, 25 (2019)**

[2] H Nasief, XA Li, *A General Framework of Delta-Radiomics for Treatment Response Prediction*, **Med. Phys. 46, 6:E294 (2019)**

[3] Lifei Zhang, et al. Ibex: An open infrastructure software platform to facilitate collaborative work in radiomics. ***Med. Phys. 42, 1341-1353*** **(2015)**

[4] H Nasief, XA Li, *Impact of Inter- and Intra-Fraction Anatomic Motions on Delta-Radiomics for Radiation Therapy of Pancreatic Cancer*, **Int. J. Rad. Onc. Bio. Phys. 102(3), S212-S213 (2018)**

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