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Balvert, Marleen; Breedveld, S.; Unkelbach, J.; den Hertog, Dick; Petit, S.

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	M18 PSA < 1 ng/ml	M18 PSA ≥ 1 ng/ml
Median (range) Δ nADC M12 vs M0	0.57 (0.57-0.72)	0.295 (0.23-0.53) p=0.034
Mean (sd) Δ nADC M12 vs M0	0.619 (0.084)	0.22 (0.33) p=0.034

Conclusion
These preliminary results show an increase in nADC after stereotactic boost radiotherapy and correlation with PSA nadir. These results should be confirmed with a larger strength and a longer follow up.

EP-1695 Intra-treatment diffusion MRI for predicting radiotherapy response in head and neck cancer patients
E. Samsøe[1], F. Mahmood[1], H.H. Johannesen[2], C. Maare[3], R.H. Hansen[4]
[1]*University Hospital Herlev, Department of Oncology-Radiotherapy Research Unit, Herlev, Denmark*
[2]*Rigshospitalet, Department of Clinical Physiology-Nuclear Medicne and PET, Copenhagen, Denmark*
[3]*University Hospital Herlev, Department of Oncology, Herlev, Denmark*
[4]*University Hospital Herlev, Department of Radiology-Research group, Herlev, Denmark*

Purpose or Objective
The purpose of this prospective case study is to analyze closely spaced diffusion weighted MRI (DWI) to monitor head and neck squamous cell carcinoma (HNSCC) tumor response throughout the entire course of radiotherapy (RT). The objective is to estimate if and when during RT the percentage (%) changes in apparent diffusion coefficients (ADCs) may be able to predict response to treatment. The % ADC change is expected to be more reproducible across centers than absolute ADC values.
Material and Methods
Fourteen patients with HNSCC were included in the original study. Three patients were excluded, yielding a total of eleven patients for the analysis. The patients had DWIs before (scan 1), twice a week during (scan 2-12), 2 weeks after (scan 13) and 8 weeks after (scan 14) chemo-RT with 33 or 34 fractions to 66 or 68 Gy in total. Not all patients complied with all planned scans. Patients were scanned with a 1T MRI scanner to acquire DWIs with 7 different b-values (b=50, b=150, b=200, b=500, b=600, b=700 and b=800 s/mm^2) in addition to T1W + contrast and T2W scans. DWI data based on mean pixel values of the regions of interest (ROIs) were fitted using a mono-exponential model to derive the apparent diffusion coefficient (ADC). The ROIs were delineated by an experienced radiologist using high b-value images (b=800 s/mm^2).
Results
This case study presents results from the analysis of two patients with a mean follow-up time of 4 years and 1 month. One of the patients (PT2) achieved complete response from the treatment. The other patient (PT8) had a local relapse 17 months after the last treatment fraction. The DWIs (b=800 s/mm^2) for PT2 and PT8 with the analyzed gross tumor volumes (GTVs) delineated at scan number 1, 6 and 11 respectively are shown in Fig. 1. The ADC for PT2 increased steadily during treatment, corresponding to a decrease in DWI signal in Fig. 1, with a mean percentage rise in ADC of 27 % from the 1st (pre RT) to the 11th (5 weeks into RT) scan, see Fig. 2. The mean rise in ADC for PT8 from the 1st to the 11th scan was only 17 %. These percentage changes in ADCs were +19 % and +10 % when considering the difference between 1st and 6th (2.5 weeks into RT) scans for PT2 and PT8, respectively.

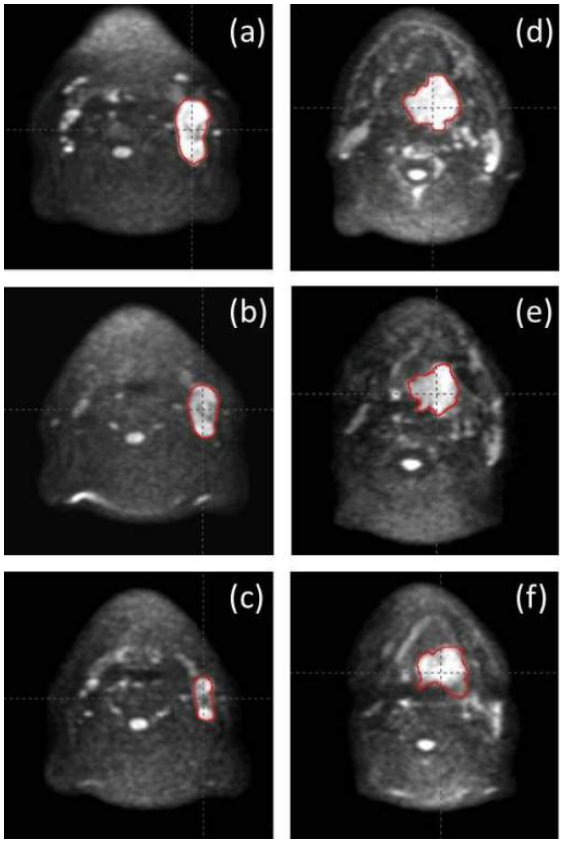


Fig. 1. DWI ROI delineation for PT2: (a)-(c) and PT8: (d)-(f) pre- (upper), 2.5 weeks intra- (middle) and 5 weeks intra-treatment (lower).

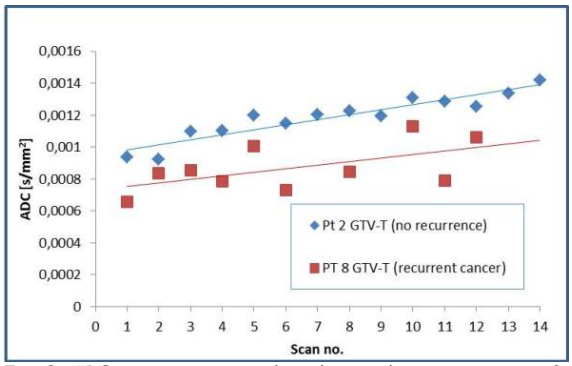


Fig. 2. ADC versus scan number during the two courses of RT for PT2 (diamonds) and PT8 (squares).
Conclusion
As early as 2-3 weeks into the course of RT, a difference between the percentage rises in ADC was observed between a well responding tumor (PT2) and a tumor which relapsed (PT8). Our results from the case study indicate that the percentage rise in ADC may be a predictor of treatment outcome. These observations comply well with observations from other centers. Further data analysis in this study may reveal an optimum time during RT for response assessment-DWI and eventually a % ADC change threshold for predicting response to treatment.

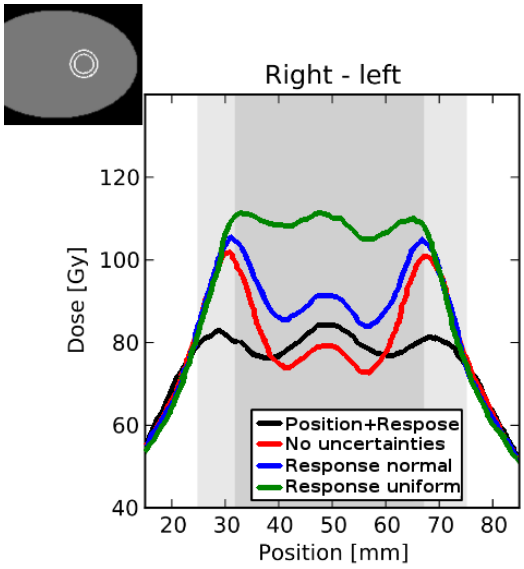
EP-1696 Dose-painting planning with uncertainties in dose-response parameters and in patient positioning
M. Balvert[1], S. Breedveld[2], J. Unkelbach[3], D. Den Hertog[1], S. Petit[2]

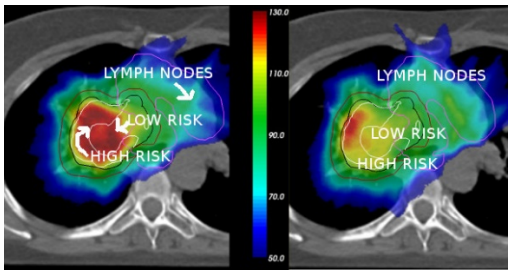
[1]*Tilburg University, Tilburg School of Economics and Management, Tilburg, The Netherlands*
[2]*Erasmus Medical Center Rotterdam Daniel den Hoed Cancer Center, Department of Radiation Oncology, Rotterdam, The Netherlands*
[3]*Massachusetts General Hospital, Radiation Oncology, Boston, USA*

Purpose or Objective
First dose-painting clinical trials are ongoing, even though the largest challenge of dose-painting has not been solved yet: to robustly redistribute the dose to the different regions of the tumor. Efforts to derive dose-response relations for different tumor regions rely on strong assumptions. Without accounting for uncertainty in the assumed dose-response relations, the potential gain of dose-painting may be lost. The goal of this study is to implement an automated treatment planning approach for dose-painting that takes into account uncertainties both in dose-response relations and in patient positioning directly into the optimization. Such that even in the presence of large uncertainties the delivered dose-painting plan is unlikely to perform worse than current clinical practice with homogeneous prescriptions.

Material and Methods
Dose response relations in TCP (tumor control probability) are modeled by a sigmoid shaped function, using 2 parameters to describe the dose level and cell sensitivity. Each voxel has its own tuple of parameters, and the parameters were assumed to follow probability distributions for which the mean and the variance were known. The expected TCP over all uncertainty distributions was optimized. Random positioning uncertainties were dealt with by convolving the pencil beam kernels with a Gaussian. For systematic geometrical uncertainties, a worst case optimization was implemented, to ensure adequate dose delivery in 95% of the geometrical scenarios. The method was implemented in our in house developed TPS and applied to a 3D ellipsoid phantom with a spherical tumor with a resistant shell and sensitive core and to a NSCLC cancer patient case with 3 subvolumes that were assumed to vary in radio-sensitivity. The effect of different probability distributions for cell sensitivity was investigated.

Results
As expected, in the absence of dose-response and positioning uncertainties (red line), the dose to the resistant ring of the phantom (light gray in Fig 1) is considerably higher than to the sensitive core (dark gray). However, as the uncertainty in dose response relations increases (blue and green lines), the dose difference between the subvolumes decreases, even though the expected cell sensitivities do not change. Including positioning uncertainties leads to further smearing out of the dose (black line). Fig 2 demonstrates the effect on a real lung patient case with high risk GTV (white), low risk GTV (black), lymph nodes (pink).





Conclusion
The uncertainties in dose-response relations of different tumor subregions can strongly affect dose-painting treatment plans. Hence, it is crucial to take these uncertainties into account in the optimization to avoid losing any potential gain of dose-painting. To the best of our knowledge this is the first implementation of a dose-painting optimization that is fully automated, and optimizes TCP taking into account both uncertainties in dose-response relations and patient positioning and that can be applied to real world cases

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EP-1697 Does contrast agent influence the prognostic accuracy of CT radiomics based outcome modelling?

S. Tanadini-Lang[1], M. Nesteruk[1], G. Studer[1], M. Guckenberger[1], O. Riesterer[1]
[1]*University Hospital Zurich, Department of Radiation Oncology, Zurich, Switzerland*

Purpose or Objective
Radiomics is a powerful tool to characterize the tumor and predict treatment outcome. The evaluation of retrospective studies is often hampered due to differences in image acquisition protocols. Whereas planning computer tomography (CT) imaging is standard of care for head and neck squamous cell carcinoma (HNSCC) patients treated with radiotherapy, the use of i.v. contrast depends on the institutional protocol and is not standardized. This was the motivation to study if mixed CT datasets including native CT images and contrast enhanced images can be used in radiomic studies.

Material and Methods
33 patients with HNSCC that received CT imaging with and without i.v. contrast before definitive radio-chemotherapy were included in the study. The primary gross tumor volume was segmented semi-automatically based on PET images acquired at the same time. 693 radiomic features (17 intensity, 60 texture, 77 in each of the 8 wavelet sub-bands (616 features)) were calculated