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Comparing FMISO and FDG positive tumour sub-volumes for PET-based dose escalation in SCCHN  
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Purpose or Objective: Tumour sub-volumes for dose escalation can be defined using different PET tracers. This study compares hypoxic volumes defined by FMISO PET and metabolically active volumes defined by FDG PET for patients with advanced squamous cell carcinomas of the head and neck (SCCHN).

Material and Methods: Imaging data of 14 patients was used, which were included in a phase II FMISO dose escalation study. Pre-therapy FMISO PET/CT images were acquired four hours post tracer injection. FDG PET/CT imaging was performed according to the institutional diagnostic protocol. The planning CT and the GTV of the primary tumour were available. Datasets were deformably co-registered using the CT images. Metabolically active sub-volumes were segmented in FDG PET images based on a source-to-background method with an adaptive threshold. Hypoxic sub-volumes were defined using a tumour-to-muscle threshold of 1.4. Expanding the volumes by an isotropic margin of five millimeters resulted in PTV-prim and potential dose escalation volumes over the course of treatment. One has to be careful with mixing radiomic features derived on planning CT and CBCT scans.

Results: Mean dose escalation volumes were 19.7 cm³ (0.0-57.3 cm³) for PTV-FMISO and 39.3 cm³ (17.5-91.9 cm³) for PTV-FDG. On average PTV-FDG covered 73.5% of PTV-FMISO (4.9-100.0%). Only for two out of fourteen patients (14%) PTV-FMISO was completely covered by PTV-FDG. Vice versa 36.3% of PTV-FDG overlapped with PTV-FMISO (0.0-97.4%). PTV-prim from treatment planning was 111.1 cm³ (57.1-201.2 cm³). Detailed results of the overlap analysis for all patients are given in Table 1.

Conclusion: For 26% of the radiomics features there is good agreement between CT1 and CBCT. 81% of the image features show high correlation between CBCT-FX1 and CBCT-FX2 where no large differences are expected. In the future, radiomic features derived from CBCT images will be used to monitor changes of CBCT features over the course of treatment. One has to be careful with mixing radiomic features derived on planning CT and CBCT scans.

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Histogram analysis of ADCs from DWMRI predicts tumour response and survival for rectal cancer  
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Purpose or Objective: Patients with locally advanced rectal cancer (LARC) are commonly treated with neoadjuvant chemoradiotherapy (CRT) followed by radical surgery. However, tumor responses vary considerably and about one third of the patients experience poor disease outcome due to metastatic progression. We aimed to investigate if apparent diffusion coefficients (ADCs) quantified from diffusion-weighted MRI (DWMRI) predicted histologic tumor response to the neoadjuvant treatment and long-term survival. Recognizing the tumor heterogeneity we specifically aimed to explore if histogram analysis of tumor ADC may reveal more useful information than the commonly used mean ADC measure.

Material and Methods: Data from 23 prospectively enrolled patients receiving induction neoadjuvant chemotherapy (NACT) followed by CRT and radical surgery was analyzed. DWMRI was acquired at baseline and after NACT. Tumor volumes contoured in T2-weighted MR images were transferred to tumor ADC maps calculated with b-values 300 and 900 s/mm², before ADCs were extracted from all tumor voxels and presented as histograms. The predictive information contained in the histograms was evaluated using receiver operating characteristic (ROC) curve analysis of each percentile from 1-100. Study endpoints were histologic tumor regression grade (TRG) and 5-year progression-free survival (PFS).

Results: Using the change in tumor ADC from baseline to NACT completion, we identified a histogram area below median (20th-40th percentiles) to be associated with both TRG and PFS. By using the 20th percentile, an increase in