wasn't statistically different between the two contouring RMI/CT respectively (p=0.63). The common contour volume SD) 18.8 cc +/- 12cc vs 20.8 cc +/- 13.6 cc on PET/CT and Results:
a PET CT before treatment. Four physicians delineated the the following order: first with the PET-CT fusion available each pt, each physician made 2 contours on the CT scan in boolean operators) was also calculated.
The percentage of common contoured volumes (CCV) on the present sample, p-values were not evaluated. The trend found for G2 patients. Due to the small statistical power of an average RR gradient of (0.54±0.15) redness/fraction was found for G1 patients, while and skin toxicity was found: an average RR gradient of patients, respectively. A strong relation between RR gradient and skin toxicity was defined as the maximum redness value of the related histogram. The OF ROI defined the redness baseline. IF RR values were plotted as a function of the corresponding fraction number and fitted with a line; the slope of this of this line is defined as RR gradient. For each patient, skin toxicity, evaluated with RTOG criteria, was compared to the RR gradient.

Conclusion: A PET/CT fusion didn’t improve the volume variation among the radiation oncologists compared to a RMI fusion. The CCV and Jaccard index were still unsatisfying with both PET/CT and RMI/CT fusion and we are planning to assess the potential impact of a liver metastases contour made by a radiologist to further improve the inter-observer variability.

EP-1879
Difference between PET and RMI fusion on delineation variability for liver metastases
R. Tanguy1, A. Gaumier1, M.P. Sunyach1, G. Beldjoudi1 1Centre Léon Bérard, Radiation Therapy, Lyon, France

Purpose or Objective: Liver metastases delineation on the dosimetric-computed tomography (CT) scan is associated with high inter-observer variations. Many authors are using a fusion of the dosimetric CT scan with a magnetic resonance imaging (MRI) to define the target volume and lower the inter-observer variations. In our center we are using PET-CT / dosimetric CT fusion or RMI / dosimetric CT fusion to delineate liver lesions depending on physicians habits. We wanted here to evaluate the benefit of each imaging registration on contouring variability.

Material and Methods: Four patients (pts) were treated with stereotactic body radiation therapy (SBRT) for 6 liver metastases. Each pt had a CT scan simulation, a liver-MRI and a PET CT before treatment. Four physicians delineated the liver lesions on the fused PET-CT and on the fused MRI. For each pt, each physician made 2 contours on the CT scan in the following order: first with the PET-CT fusion available (PET/CT), then with the CT/MRI fusion available (RMI/CT). The percentages of common contoured volumes (CCV) on PET-CT and RMI were defined using the formula: (common volume of all the physicians of the group / delineated volume of the physician) x 100. The Jaccard index (ratio between the common volume and the union volume obtained using the boolean operators) was also calculated.

Results: The volume of the delineated lesions were (mean+/ SD) 18.8 cc +/- 12cc vs 20.8 cc +/- 13.6 cc on PET/CT and RMI/CT respectively (p=0.63). The common contour volume wasn’t statistically different between the two contouring modalities with (mean+/ SD) 56.2% +/- 21.5% vs 63.4% +/- 13.9% for PET/CT and RMI/CT respectively (p=0.1) even if there was a trend for a lesser variability for RMI fusion. The overall Jaccard index (mean±SD) was 0.34±0.15 and 0.46±0.19 for PET/CT and RMI/CT respectively (p=0.26).

Conclusion: We demonstrated the feasibility of making and using gel phantoms for the assessment of isotropic diffusion kurtosis to use in the characterization of early stage prostate cancer treated with prostate brachytherapy. We have shown that the rectified noise floor, which exists in standard magnitude data, increases the systematic error of the diffusion coefficients D and K. Further studies are in progress to minimize the impact of noise floor in DKI.

EP-1880
Validation of the use of digital camera for the prediction of skin toxicity in breast radiotherapy
M. Poli1, S. Bresciani1, A. Miranti1, A. Di Dia1, A. Maggio1, M. Gatti1, F. Gabriele1, M. Stasi1 1Candiolo Cancer Institute - FPO- IRCCS, Medical Physics, Candiolo, Italy 
2Candiolo Cancer Institute - FPO- IRCCS, Radiotherapy, Candiolo, Italy

Purpose or Objective: Skin reactions are one of the most common side effects in breast cancer patient treated with radiotherapy. In this work a preliminary validation of the use of a digital camera, as a cheap and easy tool for early prediction of acute skin side effects, is presented.

Material and Methods: Twelve patients undergoing breast radiotherapy were photographed once a week with a digital camera system, composed of a reflex Canon 30D (CMOS sensor, 8.2 Megapixels) and a Tamron SP AF17-50mm f/2.8 XR. Patients were treated with two different techniques: conventional 3DCRT with Varian TrueBeam STx linac (8 patients) and Tomotherapy HD (4 patients). All photographic shots were acquired in manual raw mode with the same exposure and white balance setup. Shots were converted in the best quality format available (TIFF) and post-processed in Lab color space (Color Space Converter plugin for ImageJ). NITI) to amplify color differences. From the channel related to image redness (a*), a skin redness level was obtained for each photographed fraction by using ImageJ. In particular, two regions of interest (ROIs) were identified: one inside the treatment field (IF) and one out-of-field (OF). Redness value histograms, related to each ROI, was acquired, plotted and used to evaluate the degree of skin redness level. ROI- redness (RR) was defined as the maximum redness value of the related histogram. The OF ROI defined the redness baseline. IF RR values were plotted as a function of the corresponding fraction number and fitted with a line; the slope of this of this line is defined as RR gradient. For each patient, skin toxicity, evaluated with RTOG criteria, was compared to the RR gradient.

Results: G1 and G2 toxicities were experienced by 10 and 2 patients, respectively. A strong relation between RR gradient and skin toxicity was found: an average RR gradient of (0.24±0.09) redness/fraction was found for G1 patients, while an average RR gradient of (0.54±0.15) redness/fraction was found for G2 patients. Due to the small statistical power of the present sample, p-values were not evaluated. The trend of the fit may be correctly assessed since the first 2 weeks of treatment. Changes in skin redness were found when comparing patients treated with conventional 3DCRT with those treated with Tomotherapy. In fact, several hot spots were noticed for the conventional treatments rather than for the volumetric irradiations, that resulted in a more homogeneous skin redness.
Conclusion: Digital reflex camera can be used for quantitatively evaluate skin reactions. Moreover, it should be used to predict acute skin toxicity since the first 2 weeks of treatment. Early detection of acute skin reactions should improve patients' quality of life. The proposed method seems to be sensitive to the radiotherapeutic technique (3D CRT vs Tomotherapy). The present results may be expanded by the study of the correlation with fractionation and other treatment parameters.

**EP-1881**

Diffusion MRI predicts radiotherapy response in brain metastases

F. Mahmod, H. H. Johannesen, P. Geertsen, R. H. Hansen  
1University of Copenhagen - Herlev Hospital, Radiotherapy Research Unit RRU-Department of Oncology, Herlev, Denmark  
2University of Copenhagen - Herlev Hospital, Department of Radiology, Herlev, Denmark

**Purpose or Objective:** Radiotherapy (RT) response is generally related to changes in gross tumor volume (GTV) manifesting months later. An earlier knowledge of the treatment response may influence treatment decision. In this prospective study we investigated the correlation of parameters derived from diffusion weighted MRI (DW-MRI) acquired during RT with later GTV change of brain metastases.

**Material and Methods:** Nineteen metastases (N=19) from eight patients, treated with whole-brain irradiation (30 Gy in ten fractions) were analyzed. Patients were scanned with a 1T MRI system to acquire DW- (b = 0, 50, 100, 150, 400, 500, 600, 800 s/mm²), T2W-, T2W- and T1W scans, before start of RT (pre-RT), at the ninth/tenth fraction (end-RT) and two to three months after RT (follow-up). DW-MRI data were fitted using a bi-exponential two-compartment model to derive the perfusion fraction (f), pseudo diffusion (D_p) and the apparent diffusion coefficient (ADC). Regions of interest (ROI) were outlined by an experienced radiologist using both low b-value images (b=0 s/mm²) and high b-value images (b=800 s/mm²) for comparison, GTV change was determined using T1W images and Eclipse (Varian Medical Systems) freehand contouring tool.

**Results:** Three metastases showed total remission, fourteen showed partial response and two showed progression. Using the high b-value ROI fifteen out of seventeen metastases with total or partial response showed increased (or unchanged) f providing the highest specificity (least false positives). Using the low b-value ROI fourteen out of seventeen metastases with total or partial response showed markedly increased (or unchanged) ADC providing the highest specificity. In both cases progression of metastases was associated with decreased (or unchanged) f and ADC, respectively, i.e. no false negatives (Fig. 1).

![Fig. 1](image)

**Conclusion:** Data indicated that specific DW-MRI parameters (f and ADC) were capable of predicting RT response in brain metastases. This may become important in individualizing patients’ prognoses and offering alternative (additional) treatments with less delay. (More data is available and currently being analyzed).

**EP-1882**

Brain connectivity changes in the presence of a glioblastoma

1Fondazione Santa Lucia, Radiology, Roma, Italy  
2VRVis Zentrum für Virtual Reality und Visualisierung, Biomedical Visualization, Vienna, Austria  
3Tor Vergata University General Hospital, Department of Diagnostic Imaging- Molecular Imaging- Interventional Radiology and Radiotherapy, Rome, Italy

**Purpose or Objective:** The aim of this study is to investigate brain connectivity of post-surgical tumor patient with resting-state fMRI and diffusion tractography (DTI). This is done to understand changes occurring due to the combined effect of tumor and surgery. Common resting state (RS) network called Default Mode (DMN) and white matter (WM) tracts connecting its regions were identified. The purpose was to study whether the functional connectivity reflects the underlying structural connectivity architecture.

**Material and Methods:** RS- (TR/TE=2.00s/30ms) and DTI-data (64-directions, 3T Philips Achieva) were acquired for one healthy subject and a glioblastoma patient. FSL was used for preprocessing and RS-network identification (MELODIC). DTI were corrected for eddy current distortion and BedpostX was run to generate the basis for probabilistic tractography using ProbtrackX. Masks derived for Prefrontal Cortex (PFC), Posterior Cingulate Cortex (PCC), Left and Right Angular Gyrus (L/RAG) from DMN were used to identify the connecting fibers. Combined masks from healthy and disrupted DMN regions were applied to identify all the possible connecting tracts. A plugin for MITK with CUDA rendering system supporting volume rendering of multiple datasets and tracts was developed to enhance our research and visualization.

![Fig. 2](image)