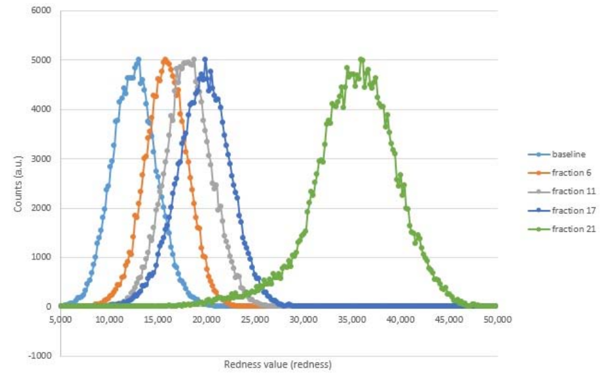

Conclusion: Digital reflex camera can be used for quantitatively evaluate skin reactions. Moreover, it should be used to predict acute skin toxicity since the first 2 weeks of treatment. Early detection of acute skin reactions should improve patients' quality of life. The proposed method seems to be sensitive to the radiotherapic 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. Mahmood[1], H.H. Johannesen[2], P. Geertsen[1], R.H. Hansen[2]
[1]University of Copenhagen - Herlev Hospital, Radiotherapy Research Unit RRU- Department of Oncology, Herlev, Denmark
[2]University 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/mm^2), T2*W-, 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/mm^2) and high b-value images (*b*=800 s/mm^2) 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).

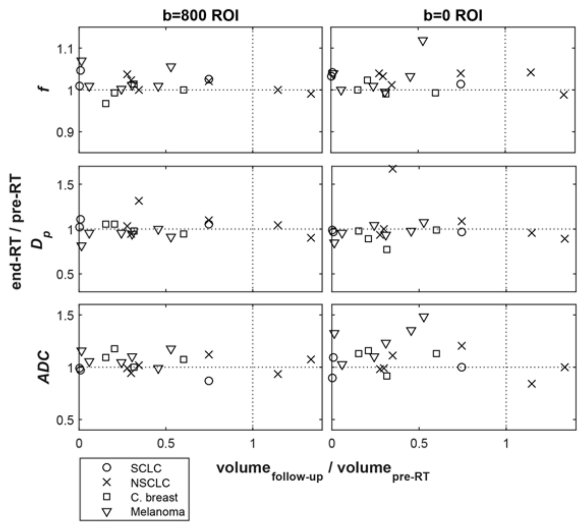

Fig. 1: Metastases are divided into primary disease and marked individually: Relative change in DW-MRI parameters (*f, D_p, ADC*) from pre-RT to end-RT, as a function of relative volume change between pre-RT and follow-up (T1W-MRI). With the *b*=800 ROI (first column), *f* has the highest specificity with no false negatives, and with the *b*=0 ROI, *ADC* has the highest specificity with no false negatives.

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

N. Tuovinen[1], M. Nunes[2], F. De Pasquale[1], C. Falletta Caravasso[1], E. Giudice[3], R. Miceli[3], G. Ingrosso[3], R. Santoni[3], K. Bühler[2], U. Sabatini[1]
[1]Fondazione Santa Lucia, Radiology, Roma, Italy
[2]VRVis Zentrum für Virtual Reality und Visualisierung, Biomedical Visualization, Vienna, Austria
[3]Tor 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.

Results: The healthy subject had undisrupted DMN. Patient DMN shows functional connectivity in PCC weakened and pushed inferior. The tract in the tumoral hemisphere connecting PFC to PCC was interrupted. In addition, LAG was pushed anterior by the tumor. In this case, DTI revealed displacement of the WM tracts connecting PCC to LAG anterior of the tumor.

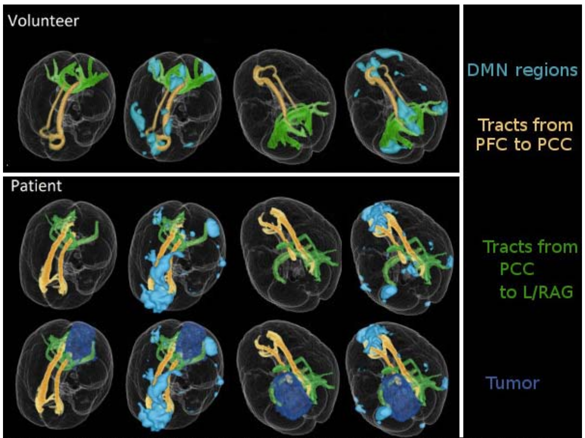

Figure: Default Mode Network and connecting tracts between its regions (PFC, PCC, L/RAG) shown for volunteer and patient with glioblastoma.

Conclusion: Our findings suggest that connectivity is somehow preserved in tumor patient. Surgery could explain the interruption of the tract on tumoral hemisphere between PFC to PCC. The displacement of the tract between PCC and LAG can be explained by anatomical shift caused by the tumor. The changes identified in the DMN were in strong agreement with the interruption and displacement of the tracts revealed by tractography. The weakening of the PCC could be explained by the interrupted tract, whereas the displacement of the tract did not seem to affect the strength of LAG. In conclusion, our results suggest that the structural damage induces abnormal functional connectivity. This agreement of functional and structural connectivity strengthens the belief that functional connectivity estimates neural connectivity.

EP-1883

Functional brain connectivity in glioblastoma patients pre- and post-radiotherapy

N. Tuovinen[1], F. De Pasquale[1], C. Falletta Caravasso[1], E. Giudice[2], R. Miceli[2], G. Ingrosso[2], R. Santoni[2], A. Laprie[3], U. Sabatini[1]
[1]Fondazione Santa Lucia, Radiology, Roma, Italy
[2]Tor Vergata University General Hospital, Department of Diagnostic Imaging- Molecular Imaging- Interventional Radiology and Radiotherapy, Rome, Italy
[3]Institut Claudius Regaud, Department of Radiation Oncology, Toulouse, France

Purpose or Objective: The aim of this study is to investigate longitudinal functional brain connectivity of post-surgical tumor patients with resting-state fMRI. This is done to understand changes occurring due to the combined effect of tumor, surgery and radiotherapy (RT). Special interest was given to connectivity changes in a common resting state (RS) network called Default Mode (DMN) and especially its functional hub posterior Cingulate Cortex (pCC).

Material and Methods: RS-data (TR/TE=2.00s/30ms, 3T Philips Achieva) was acquired for three glioblastoma patients pre- and post-RT. Patient1 had a tumor lesion near pCC, patient2 had a lesion near Prefrontal Cortex (PFC) and patient3 near the Right Frontal Eye Field (RFEF). Karnofsky performance scores (KPS) were evaluated. KPS for patient1 remained 80, for patient2 remained 90 and for patient3 decreased from 80 to 70 post-RT. FSL was used for preprocessing and DMN identification (MELODIC). pCC node was derived from DMN and pCC-to-brain connectivity maps were computed. Maximum, minimum and mean dose (cGy) on contours of GTV and pCC were calculated and percentual isodoses for 30/50/70/90% were evaluated from the treatment planning.

Results: DMN was recognizable in all timepoints although topology changes during the treatment were noted. When looking at the seed-to-brain connectivity maps (Fig.1) seems that RT given on the affected network hub pCC (patient1) helps to improve the global connectivity to frontal regions of the DMN. In addition, connectivity becomes more focused post-RT. In patient2, RT given on PFC region seems to increase local connectivity temporarily in the frontal region. For patient3 whose RT was not involving DMN, the functional connectivity becomes more aspecific post-RT.

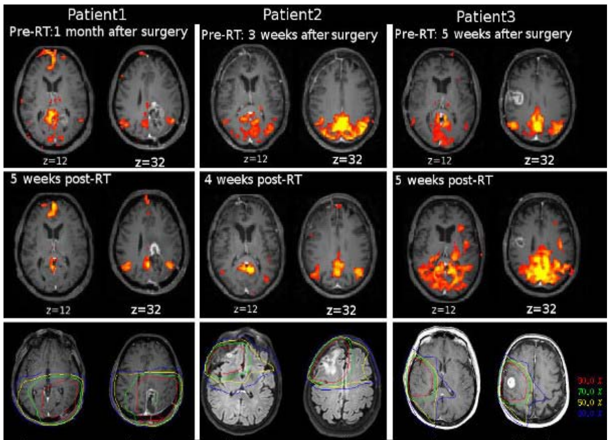

Figure 1: PCC-to-brain connectivity maps pre and post-RT and percentual isodose curves for three glioblastoma patients.

	cm³	Dose$_{min}$(cGY)	Dose$_{max}$(cGY)	Dose$_{mean}$(cGY)
Patient1 GTV	41,9	5895,4	6252,8	6033,2
Patient1 pCC	3,5	5923,9	6019,1	5971,5
Patient2 GTV	6,2	6036,4	6290	6168
Patient2 pCC	4,7	650,4	1478,9	1061,1
Patient3 GTV	8,4	5988,4	6255,2	6130
Patient3 pCC	6,2	1040	3116	1518,4

Table 1 Minimum, maximum and mean doses received to Gross Tumor Volume and pCC.

Conclusion: Interestingly, RT near pCC seems to increase global connectivity. This might be due to the fact that we are treating a central node and thus the communication between the brain regions is re-established when the central node improves its connectivity. In addition, seems that RT near prefrontal cortex helps to increase connectivity locally. However, as this node is not an important connectivity hub, there is no improvement in connectivity to far away regions. When RT was not involving DMN, we noted a deterioration of functional connectivity. Interestingly, this patient showed also decrease in clinical performance reflecting these connectivity changes.

EP-1884

Voxel based topological PET SUV changes of bone marrow for LACC RT effect on hematological toxicity

A. Gulyban[1], P.V. Nguyen[1], J. Hermesse[1], P.A. Coucke[1], F. Lakosi[1]
[1]Liege University hospital, Radiation Department, Liege, Belgium

Purpose or Objective: To evaluate the topological voxel-based FDG-PET SUV changes of bone marrow including dose from radiotherapy for locally advanced cervical cancer patients and their effect on hematological toxicity.

Material and Methods: Between February 2013 and December 2014 fourteen patients were treated with using advanced radiotherapy delivery technique (IMRT or VMAT). Diagnostic FDG-PET with low-dose CT whole body scans were performed before and after radiotherapy (preRT and postRT - PET/CT). During the chemotherapy (six planned cycle) hematological toxicities were gathered for hemoglobin (HGB), white blood cell count (WBC), absolute neutrophil count (ANC) and for pallet count (PLT). Co-registration