	Rigid	Demons	B-Spline
Pre-treatment	5.2 ± 1.6	3.2 ± 1.3	2.4 ± 1.0
Mid-treatment	5.9 ± 1.6	3.4 ± 1.1	3.6 ± 1.5
Post-treatment	8.3 ± 1.9	7.2 ± 3.3	5.8 ± 2.6

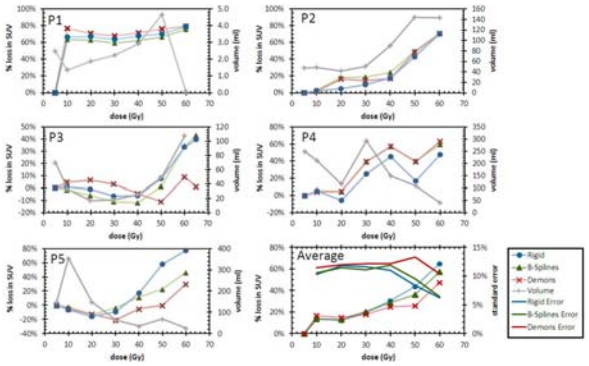

Figure 1: Loss in perfusion as a function of radiotherapy dose for each patient and averaged over all patients.

EP-1531

Image registration framework to investigate children neurocognitive outcome after focal brain irradiation

S. Meroni[1], E. Montin[2], F. Arrigoni[3], C. Cavatorta[1], G. Poggi[4], C. Oprandi[4], E. Pecori[5], E. Schiavello[6], B. Diletto[5], M. Massimino[6], L. Mainardi[2], E. Pignoli[1], L. Gandola[5]
[1]Fondazione IRCCS Istituto Nazionale dei Tumori, Medical Physics, Milan, Italy
[2]Politecnico di Milano, Dipartimento di Elettronica Informazione e Bioingegneria, Milan, Italy
[3]Fondazione IRCCS E.Medea La Nostra Famiglia, Neuroradiology, Bosisio Parini (LC), Italy
[4]Fondazione IRCCS E.Medea La Nostra Famiglia, Child Neuro Oncology Rehabilitation Unit, Bosisio Parini (LC), Italy
[5]Fondazione IRCCS Istituto Nazionale dei Tumori, Pediatric Radiotherapy Unit, Milan, Italy
[6]Fondazione IRCCS Istituto Nazionale dei Tumori, Pediatric Oncology Unit, Milan, Italy

Purpose/Objective: To evaluate the reliability of a framework for correlation of dose distribution (DD) and Magnetic Resonance (MRI) information related to long term neurocognitive outcome in pediatric patients (pts) focally irradiated for primitive malignant brain tumors. Image registration during oncological therapy is a difficult task, which becomes even harder when there is a large gap between acquisition times of successive scans.

Materials and Methods: The main challenges of the workflow were the fusion of CT on a morphological MRI acquired at the time of the treatment (MR0) and the fusion of MR0 with the revaluation morphological MRI (MR1) and functional diffusion tensor imaging (DTI) acquired 3 to 10 years after RT. As a pilot study CT and DD were collected for 18 pediatric pts who completed RT at least 3 years before revaluation. CT and DD were registered to MR0, following a multi step process made of rigid registrations. The registered images were further matched with MR1 through a global (affine) and a local (free form deformation based on b-spline) deformation using mutual information as similarity metric. A similar approach was used for the functional registration. The alignment was scored by a neuroradiologist, a radiotherapist and a medical physicist by drawing contours of regions of interest (ROI) on the source images. The ROIs were deformed using the deformation field estimated by the registration procedure and superimposed to their target images, thus making the evaluation possible. By applying this framework it was possible to map the DD and the DTI maps on a common space defined by the MR1 for the subsequent statistical evaluation. A brain atlas was registered on MR1 by rigid and non rigid registrations in order to label white matter regions of interest. Correlation of white matter regions, DD and DTI maps was then achievable. Neurocognitive tests were made to evaluate cognitive and psychological features and executive functions of the pts. Statistical analysis is being performed.

Results: For the CT-MR0 registration the average score obtained was 2.27 (being 0 the score assigned to the perfect alignment and 5 to the worst one. 3 was considered sufficient), while the MR0-MR1 fusion obtained 1.47; and DTI-MR1 fusion 1.1. Concerning the statistical analysis, preliminary results indicate a correlation between dose values and fractional anisotropy values obtained from DTI maps for the frontal superior lobe left and right, the right anterior cingulum and right putamen.

Conclusions: Our multi step registration process was able to account for different positions of the patient during the radiological studies and even for patient growth. The low score obtained for CT-MR0 registration was mainly due to the poor quality of older CT images. This image registration study represents the backbone of a larger clinical study that will also include prospective pts to correlate DD to functional neurocognitive damages.Partially founded by Associazione Italiana per la Ricerca sul Cancro (AIRC)

EP-1532

Dental prosthesis artifact reduction for head and neck patients

P. Fenoglietto[1], L. Bedos[1], P. Dubois[1], A. Fenoglietto[1], J.B. Dubois[1], N. Ailleres[1], D. Azria[1]
[1]CRLC Val d'Aurelle - Paul Lamarque, Radiation Oncology, Montpellier, France

Purpose/Objective : Head and Neck patients undergoing radiotherapy treatments generally present many reconstructed teeth p metal implants generating artifact during CT acquisition. This leads to a poor image quality and impossibility to clearly delineate target and organs at risk. This work evaluated the accuracy of a new Metal Artifact Reduction (MAR) algorithm recently released (GE Healthcare) to increase image quality in this challenging condition.

Materials and Methods: A CT of a dental arcade phantom build with reconstructed teeth was acquired in different conditions on a GE Optima CT580 CT simulator. First image was obtained without any metal crown but with some teeth fill with a cement containing Zinc Oxide (ZnO: 5.6 g/cm3) and Barium Sulphate ($BaSO_4$:4.5 g/cm3) (Case 1). A second one with metal prosthesis including 2 teeth prosthesis in Chrome Cobalt (CrCo: 8.5 g/cm3) and 3 in Nickel Chrome (NiCr: 8,4 g/ cm3) was realized (Case 2). Hounsfield Unit