**Title:** Feasibility of direct VMAT treatment planning on MRI generated Pseudo-CT image

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**Introduction:** In radiation therapy, MRI images are necessary to precisely delineate patient’s structures. Several commercially available algorithms exist that generate Pseudo-CT (pCT) images, directly from MRI sequences, allowing dose calculation without realizing any supplementary CT-simulation acquisition. In this study, an optimized algorithm is used to produce the pCT images for pelvic regions. VMAT plans were then calculated using these images and compared to the calculations realized on the conventional CT (cCT) data.

**Methods:** Generally, the pCT image generation is realized by algorithms that work on existing patient databases (Atlas-based algorithms), that include CT and MRI series, already matched. A mean value (MV) image is generated from the atlas, and an elastic fusion is performed on the patient MRI, in order to produce the pCT image required. The new proposed algorithm realizes a locally weighted (LW) selection from the atlas images, before proceeding with the fusion and pCT generation.

A retrospective study was realized, for a sample of 12 patients treated for rectal tumors. pCT images generated by classic algorithms (MV), by the new optimized algorithm (LW), as also homogeneous patient body images (HU=0) were inserted to the treatment planning system (TPS). The initial treated plan (reference) was re-calculated on the different image series, and the resulting dose matrices were compared in terms of DVH and 2D Gamma Index (GI). The absolute isodose volumes corresponding to the dose differences were also calculated.

TPS: Eclipse v13

* Calculation algorithm: AAA v.10
* Energy: 6MegaVolt
* Irradiation technique: VMAT
* Calculation resolution: 2.5x2.5mm

**Results:** The dosimetric comparison showed that calculations based on the new optimized algorithm (LW) are well precise. However, the difference between calculations on the different series is not clinically relevant. The GI based differences were only visible for 1% dose and 1mm distance criteria. In that case, the percentage of points with GI>1 were (mean±1SD in %)

91.40±7.56 CT-RT vs homogeneous image,

96.00±4.11 CT-RT vs MV image (pCT classique)

97.67±3.60, CT-RT vs LW image (pCT améliorée)

The results for the mean volume of the dose differences are visible in the annex (Figure 1)

**Conclusions:** The treatment planning on pCT images is possible and sufficiently precise of pelvic regions. The new algorithm proposed showed a promising potential for use on dose calculations in MRI-only treatment planning.

**References:**

[1] Arabi H, Koutsouvelis N, Rouzaud M, Miralbell R and Zaidi H “Atlas-guided generation of PseudoCT images for hybrid PET-MRI and MR-only based radiotherapy treatment planning” **Phys Med Biol** (2015) *submitted*

ANNEX



Figure