PO-0927
Bone texture analysis as predictive of bone radiation damage in patients undergoing pelvic RT. V. Nardone1, M. Biondi2, P. Tini1, L. Sebaste1, E. Vanzi2, G. Battaglia1, P. Pastina1, L.N. Mazzoni2, F. Banci Buonamici2, L. Pirtoli1
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Purpose or Objective: To assess the potential role for a CT-based, bone texture analysis as a predictive factor of bone radiation damage in patients undergoing radiotherapy (RT) for pelvic malignancies.

Material and Methods: We performed a retrospective analysis of suitable patients treated with RT for pelvic malignancies from January 2010 to December 2014. The Dicom CT data acquired for RT planning were collected, and used for a homemade ImageJ macro analysis. Two region of interest (ROI) were selected: the L5 vertebral body and the femoral heads. Typical texture analysis (TA) parameters were retrospectively evaluated: mean (M), standard deviation (SD), skewness (SK), kurtosis (K), entropy (E) and uniformity (U).

The patients who developed bone RT-related damages (i.e.: pelvic bone stress fracture, radiation osteitis, insufficiency fractures) during the follow-up constitute the study patients (SP) group. The TA data were collected for a comparative analysis also in a control group of patients (CP: 2:1 ratio, with respect to SP) not developing bone damages. The CPs were matched taking into account: age, sex, type of tumor, intent of postoperative treatment, comparable doses to the considered organs-at-risk. As for the statistical comparisons, we performed a univariate analysis (Pearson correlation) and a multivariate analysis (logistic regression) using the SPSS software 17.0.

Results: Twenty-four SPs and 48 CPs are the subject of this report. Out of SPs, postoperative RT was delivered for cancer of the digestive tract (anal or rectal) in thirteen patients (54%); of the female reproductive organs (endometrial or cervical) in 9 (37%); and of the excretory apparatus (prostate or bladder) in 3 patients (9%). In the comparison between SP and CP groups, the univariate analysis showed a significant correlation of the ROI parameters of L5: SD (p:0.012); K (p<0.001), E (p: 0.001); U (p:0.008), and of the femoral head: M (p<0.001); SD (p<0.001), with the development of bone damage. The logistic regression highlighted a significant correlation with the ROI parameters of L5: E (p:0.004); U (p:0.014), and femoral head M (p:0.022); and SD (p:0.042), with an Overall Model Nagelkerke R Square of 0.590.

Conclusion: These results (with the limit of a small series) and those reported in previous related studies deserve some interest, since the knowledge of predictive factors of bone radiation damage might help in patients' selection for pelvic RT, and in identifying suitable dose constraints for the bony pelvis in RT planning for patients at risk.

PO-0928
Impact of fuzzy-thresholding of 18F-FDG PET images for cervical cancer recurrence prediction G. Roman Jimenez1, A. Devillers2, J. Leseur2, J.D. Osipina1, H. Der Sarkissian1, O. Acosta1, R. De Crevoisier1
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Purpose or Objective: In case of cervix cancer irradiation, parameters extracted from initial 18F-FDG-PET images can be used to predict recurrence. FDG PET parameters are classically computed among voxels binary selected in the segmentation step. We proposed the use of fuzzy-thresholding for providing tumor membership probability map, and present a generalization of the computation of FDG PET parameters by weighting each PET voxel by its tumor membership probability. The goal of the study was to evaluate the relevance of fuzzy-threshold based weighted parameters in prediction of tumor recurrence, in comparison with a “standard” fixed or hard threshold based parameters.

Material and Methods: This study included 53 patients treated for locally advanced cervical cancer by external beam radiation therapy with concurrent chemotherapy, followed by brachytherapy and ± surgery. All patient underwent 18F-FDG PET/CT exam before the treatment. Different tumor membership probability maps were extracted from 18F-FDG PET images using fuzzy-thresholding defined by a threshold Th and a level of fuzziness ΔTh (both expressed in % of the maximum uptake value) using a Zadeh’s standard function. Fuzzy-thresholding were tested with Th=41%, 50% and 70% and ΔTh from 0% to 40% (ΔTh=0% corresponding to hard-thresholding). Using the fuzzy-thresholding, we computed weighted analogs of four standard 18F-FDG PET parameters; the maximum uptake averaged by its 26 neighbors (SUVpeak), the average SUV inside the tumor region (SUVmean), the metabolic tumor volume (MTV) and the total lesion glycolysis (TLG). The recurrence was defined based on clinical examination, MRI and PET imaging. Median follow-up was 49 months [range: 7-83]. A total of 16 patients developed disease recurrence. The predictive capability of the PET parameters to predict 3 year overall recurrence were evaluated using the area under the receiver operating characteristic curve (AUC) and the p-value of the logistic regression model.

Results: The figure shows the predictive values (AUC and p values) of the weighted parameters depending on the threshold Th and the fuzzy-level Δth used. SUVpeak and SUVmean were not predictive for any of the segmentations tested. TLG and MTV extracted through hard-thresholding (ΔTh=0%) were highly predictive with Th=41% (AUC=0.74, p=0.012) and Th=50% (AUC=0.77, p=0.006) but not with Th=70%. Weighted parameters were discriminative (p<0.05) at Th=41% with Δth = [0% - 22%], at Th=50% with Δth = [0% - 32%] and at Th=70% with Δth = [0% - 32%] indicating a lower sensitivity to the choice of threshold.

Conclusion: PET weighted parameters including voxels tumor membership probability can be used to predict tumor.