Choline PET/CT radiomic analysis for newly diagnosed prostate cancer: An early monocentric experience

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Introduction & Objectives: Prostate cancer (PCa) risk-classification is mainly based on biopsy-based Gleason score (GS), despite it represents an invasive tool and would not mirror the heterogeneous involvement of the entire gland. The radiomic approach is able to extract many quantitative imaging features, so indirectly providing biologic characteristics of tumor. Radiomics applied on Positron emission tomography/computed tomography with Choline derived radiopharmaceuticals (18F-FECH PET/CT) images were shown to predict disease status at follow-up in restaging setting patients. However, its diagnostic role remains still unexplored. This study aimed to assess the diagnostic performance of 18F-FECH PET/CT radiomics for staging intermediate/high-risk PC patients.

Materials & Methods: Rectal examination, PSA (PSAtot) of suspected PC patients were collected. After biopsy-based GS assessment, all patients underwent 18F-FECH PET/CT scan. 60 min post-injection whole body images were considered. Volume of interests (VOIs) were placed on PC lesions, by contouring the whole prostate and avoiding spill-over from radioactivity in the bladder. Radiomic features were extracted from each VOIs. Univariate analyses (Mann–Whitney U test) were performed among each radiomic features and main outcomes: PSA, rectal examination, perineural spread of disease and GS. Bivariate analysis was conducted among more relevant features, (with p<0.05 at univariate analysis) and clinical outcomes, by a cross-fold validation (10 repetitions, 20% of testing set). Best model selection was based on the mean Area Under the Curve and its standard deviation (meanAUC and sdAUC).

Results: 68 consecutive PC patients were retrospectively considered. Median PSA was 9.3 ng/mL (IQR 6.9). Rectal examination was suspected of PC in 26/68 patients (38.2%). GS was 3+4 in 9/68 patients (13.2%), 4+3 in 20/68 (29.4%), 3+5 in 1/68 (1.5%), 4+4 in 19/68 (27.9%), 4+5 in 18/68 (26.5%), 5+4 in 1/68 patients (1.5%). The aforementioned variable have been dichotomized on the base of the median (for numerical) and GS as 0 if less or equal to 7 and 1 if greater. There is no significant cross-reaction among considered outcomes, at the Fisher’s exact test. Among more relevant feature at univariate analysis, following parameters showed good diagnostic performance: F_szm_2.5D.z.entr + lesion_F_stat.energy with PSAtot as outcome (meanAUC 0.82; sdAUC 0.16); F_stat.kurt + F_stat.Nic.entropy with rectal examination as outcome (meanAUC 0.80; sdAUC 0.11); lesion_F_cm.info.corr.1 + lesion_F_szm_2.5D.szhge GS as outcome (meanAUC 0.84 sdAUC 0.16).

Conclusions: This pilot study shows that 18F-FECH PET/CT radiomic analysis seems effective in predicting the presence and severity of PC at staging, so representing a non-invasive tool for management of these patients at diagnosis.