JNM
The Journal of Nuclear Medicine

Meeting Report | Technical Advances & Quantification (this would include image-guided diagnostics/therapy)

Reproducibility of lung cancer radiomic features extracted from data-driven respiratory gating and free-breathing flow imaging in 18F-FDG PET/CT

Daphne Faist, Mario Jreige, Valentin Oreiller, Marie Nicod Lalonde, Niklaus Schaefer, Adrien Depeursinge and John Prior

Journal of Nuclear Medicine June 2022, 63 (supplement 2) 4005;

Abstract

4005

Introduction: The recently introduced data-driven respiratory gating (DDG) PET/CT has shown a superior performance to non-gating and could be widely implemented in clinical routine for lung lesion characterization. Lung cancer radiomics has shown promising perspectives in detection and classification of lung nodules, determination of histology and genomic characteristics and treatment outcome prediction. However, quality and reproducibility of radiomics studies remain essential considerations for the generalization of radiomics models.

The aim of this study was to evaluate the impact of DDG on the reproducibility of radiomic features derived from ^{18}F-FDG PET/CT in comparison to free-breathing (FB) flow imaging.

Methods: We retrospectively analyzed free-breathing flow and DDG acquisitions of ^{18}F-FDG PET/CT scans from 20 patients addressed for initial staging of lung cancer. One or two lung nodules were delineated per patient with a volume of interest (VOI) defined by a 42% threshold from the maximum standardized uptake value. Radiomic features were subsequently derived using the QuantImage v2 platform (https://quantimage2.ehealth.hevs.ch) for both FB and DDG data of each patient. To compare the two methods, we calculated Lin's concordance factor (r_c) which is equal to the Pearson correlation coefficient multiplied by

the bias correction factor (C_b). In addition, we calculated the mean difference percentage (DIFF%) between the two imaging methods. Non-reproductible features were defined as having a C_b<0.8 and/or a DIFF%≥10%.

Results: In total, 146 features were computed and 10 (6.8%) were considered as non-reproducible. Regarding first-order statistics and shape features, 8/89 (9.0%) showed important differences between FB and DDG acquisitions from Laplacian of Gaussian (LoG)-filtered images (sigma=1mm): Energy (C_b=0.86; DIFF%=11), Kurtosis (C_b=0.76; DIFF%=7.2), Minimum (C_b=0.72; DIFF%=8.4), Range (C_b=0.77; DIFF%=7.5), RootMeanSquared (C_b=0.79; DIFF%=5.5), Skewness (C_b=0.79; DIFF%=4.3) and Variance (C_b=0.74; DIFF%=11). Regarding Gray Level Cooccurence Matrix (GLCM), only 2/22 (9%) features showed significant differences between FB and DDG: ClusterProminence (C_b=0.94; DIFF%=10.5) and DifferenceVariance (C_b=0.77; DIFF%=10.4), while only 1/19 (5%) SUV features was significantly different: Kurtosis (C_b=0.78; DIFF%=6.3). All other 16 features derived from SUVpeak, MTV and TLG showed complete reproducibility.

Conclusions: This study showed that most lung cancer radiomic features (136/146 or 93%) can be used interchangeably on data-driven respiratory gating imaging and free-breathing imaging, based on the observed reproducibility of the features between both acquisitions. The results suggest that the 10 radiomics features with highest variability are affected by FB and should only be used with DDG images where the respiratory motion is controlled.

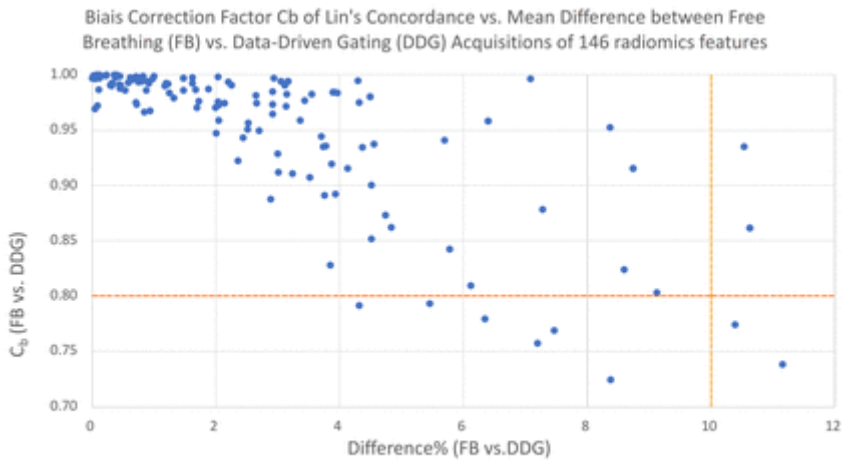

Figure S1. Out of the 146 radiomics features investigated in this study, most of them (136 or 93%) are well reproducible FB and DDG acquisitions and only 10 are considered out of bounds (defined as Cb<0.8 or Difference≥10%)

Download figure

Open in new tab

Download powerpoint

Previous

Back to top