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Impact of a Gaussian filter applied to post-reconstruction PET images on radiomic features to predict complete pathological response in breast cancer

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Abstract

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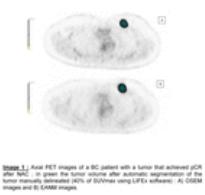
Introduction: Breast cancer (BC) is a common referral for ^{18}F-FDG PET/CT especially in patients for which neodjuvant chemotherapy (NAC) is indicated. Radiomic features (RF) are associated with tumor heterogeneity and prediction of pathological complete response (pCR) in BC. We previously found that the application of a post-reconstruction filter on PET images lead to differences in BC metabolic phenotype on ^{18}F-FDG PET/CT. In that setting, we aimed to assess if it would also affect prediction of pCR in BC patients.

Methods: BC patients who underwent ^{18}F-PET/CT at initial staging in our institution were recruited. ^{18}F-PET/CT scans were acquired on a GE Discovery 690 PET/CT machine 60-80 min after injection of 3.5 MBq/kg of ^{18}F-FDG if capillary blood glucose was <11 mMol/L. After referral, some patients underwent NAC (association of taxanes+anthracyclines), with or without trastuzumab in HER2-expressing tumors. pCR was defined as the absence of residual tumor disease on the surgical specimen using Sataloff classification defined as TA. Two datasets of images were analyzed, first PET images with OSEM reconstruction (OSEM). The second set of PET images was obtained in accordance with the EARL (EANM) requirements using a 7-mm Gaussian post-filter (EANM). For both OSEM and EANM images, SUVs (max, mean, peak), 4 histogram-based features and 31 textural indices (TI) included 6 robust TI (Homogeneity, Entropy, SRE, LRE, LGZE and HGZE) were extracted on the same tumor volume after automatic segmentation of the tumor manually delineated (40% of SUVmax using LIFEx software). t-tests for independent samples were used to compare RF as a function of pCR.

Results: Nineteen patients with 20 tumors were included. Nine patients achieved pCR according to Sataloff classification. Looking at the performance of RF to predict pCR, we found that 2 RF extracted from EANM images were significantly associated with pCR: Homogeneity (p=0.04) and RP (p=0.045), whereas none were found from OSEM images. We also found several RF with borderline significances (p<0.1): 4 TI on EANM (Entropy p=0.08, SRE p=0.08, LRE p=0.08 and LZE p=0.097) and 3 TI on OSEM (Entropy p=0.08, LRE p=0.065 and RP p=0.07).

Conclusions: We found that the application of a post-reconstruction filter on PET images lead to differences in RF performance for prediction of pCR. Interestingly, though the application of a Gaussian filter decreases PET images resolution and uniformizes SUV among different PET scanners, the only statistically significant RF associated with pCR were extracted from the EANM-based tumor volume. Nonetheless, further data collection on a larger population is ongoing in order to confirm these preliminary results.



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