Evaluation of effective reconstruction parameters on quantification of PET/CT images for harmonization: A phantom study

Habibeh Vosoughi[1,2*], Parham Geramifar[3], Mohsen Hajizade[1]
Arman Rahmim[4], Farshad Emami[2], Mehdi Momennezhad[1]

1- Department of Medical Physics, Mashhad University of Medical Science, Mashhad, Iran
2- Nuclear Medicine Department, Razavi Hospital, Imam Reza International University, Mashhad, Iran
3- Research Center for Nuclear Medicine, Shariati Hospital, Tehran University of Medical Science, Tehran
4- Departments of Radiology and Physics & Astronomy, University of British Columbia, Vancouver, Canada

Background: Nowadays, the use of hybrid PET/CT imaging has increased. Among the valuable applications of PET/CT images, the role of PET/CT in response evaluation, restaging after therapy and assessment of suspected recurrence using quantitative and semi-quantitative analysis is completely clear. The aim of this study is evaluation of reconstruction parameters on image quality and quantitative values were obtained from the PET/CT images for harmonization.

Methods: Imaging of IQ-NEMA phantom with specific SBR was performed by Siemens Biograph6 TrueV PET/CT scanner. PET acquisition was 10 min listmode on one bed position. The raw data of PET was reconstructed using 6 different values of (iteration x subsets) and Gaussian post-smoothing filter with FWHM 2, 4 and 6 mm. Also, image reconstruction was performed with and without resolution recovery (3D and HD mode). For assessment of image quality CNR and COV and for quantification RC_{max}, $RC_{A50\%}$ and RC_{peak} was calculated.

Results: Increasing ixs and FWHM of Gaussian filter caused to improve CNR and COV. For smaller number of ixs, RC values for small spheres underestimate compared with EARL accreditation specification, but for larger spheres were matched. The closest curve to EARL accreditation specification was created by increasing ixs and Gaussian filter with FWHM 4 and 6mm. But using the Gaussian filter with width of 2mm, RC values overestimate relative to EARL. Using HD algorithm with FWHM 6mm of Gaussian filter is suitable for harmonization.

Conclusion: Reconstruction parameters have an important role in determination of true activity and accurate calculation of SUV. It is recommended that for comparison quantitative values in various situations for response assessment, reconstruction algorithms should be optimized and harmonized.

Keywords: PET/CT, image reconstruction, quantification, harmonization, EARL accreditation