Considering of the ability of PET imaging including peripheral background

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Abstract

Background and purpose: FWHM shows the ability of the PET crystals to separate two point sources. It usually obtained by point source measurements where background activity in the periphery of the sources is negligible. However, there is no denying the fact that partial volume effects and the BG count around the tumor affect the PET's FWHM. This means that SUV is varied depending on whether there is BG or not. In this study we tried to examine how the FWHM is affected by BG counts.

Method: Test 1 (cheking resolution): We used six extension tubes, each of which were coiled six times around a 20 ml syringe and affixed to it. Extension tubes were then filled with FDG 2.65KBq * 4.0 (imaged SUV 4.0). In the case of the FDG in one tube of the six, the distance of tubes is 12.5 mm. With FDG in the two tubes, the distance is 10.0 mm, and when the six tubes are all filled, the distance is 2.0 mm. Emission scans were run for three minutes. Test 2 (cheking images): In addition to the extension tubes, the syringe was filled with FDG, and the concentration of the FDG in the extension tubes were adjusted to be the concentration equivalent to SUV 4.0, 8.0 and 16.0. PET images were reconstructed at 4.0, 2.0 and 1.0/Pixel. Assuming the FDG in the syringe as the BG, we examined the PET slice images.

Results: The accumulation of the FDG in the extension tubes was able to be observed separately until the filled tubes were five, (the distance of the extension tube is 3.0mm,) but when 6 tubes were all filled, (distance of the extension's tube is 2.0mm,) the accumulation image became vague. In test 2, we were not able to see extension tubes of SUV 4.0 and 8.0, but we could observe the extension tube of SUV 16.0.

Conclusion: PET cannot show the cold area of the diameter 1.0 mm, even if the BG is negligible there. When the SUV is 16.0 or more, PET can image 1.0-mm thick tumors.