

学位論文の要旨

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主論文の題名

The value of Bayesian penalized likelihood reconstruction for improving lesion conspicuity of malignant lung tumors on ^{18}F -FDG PET/CT: comparison with ordered subset expectation maximization reconstruction incorporating time-of-flight model and point spread function correction

主論文の要旨

Objective

To evaluate the value of Bayesian penalized likelihood (BPL) reconstruction for improving lesion conspicuity of malignant lung tumors on ^{18}F -fluoro-2-deoxy-D-glucose (FDG) positron emission tomography computed tomography (PET/CT) as compared with the ordered subset expectation maximization (OSEM) reconstruction incorporating time-of-flight (TOF) model and point-spread-function (PSF) correction.

Methods

Twenty-nine patients with primary or metastatic lung cancers who underwent ^{18}F -FDG PET/CT were retrospectively studied. PET images were reconstructed with OSEM + TOF, OSEM + TOF + PSF, and BPL with noise penalty strength β -value of 200, 400, 600, and 800. The signal-to-noise ratio (SNR) was determined in normal liver parenchyma. Lung lesion conspicuity was evaluated in 50 lung lesions by using a 4-point scale (0, no visible; 1, poor; 2, good; 3, excellent conspicuity). Two observers were independently asked to choose the most preferred reconstruction for detecting the lung lesions on a per-patient level. The maximum standardized uptake value (SUV_{max}) was measured in each of the 50 lung lesions.

Results

Liver SNR on the images reconstructed by BPL with β -value of 600 and 800 (17.8 ± 3.7 and 22.5 ± 4.6 , respectively) was significantly higher than that by

OSEM + TOF + PSF (15.0 ± 3.4 , $p < 0.0001$). BPL with β -value of 600 was chosen most frequently as the preferred reconstruction algorithm for lung lesion assessment by both observers. The conspicuity score of the lung lesions < 10 mm in diameter on images reconstructed by BPL with β -value of 600 was significantly greater than that with OSEM + TOF + PSF (2.2 ± 0.8 vs 1.6 ± 0.9 , $p < 0.0001$), while the conspicuity score of the lesions ≥ 10 mm in diameter was not significantly different between BPL with β -value of 600 and OSEM + TOF + PSF. The mean SUV_{max} was increased by BPL with β -value of 600 for the lung lesions with < 10 mm in diameter, compared to OSEM + TOF + PSF (3.4 ± 3.1 to 4.2 ± 3.5 , $p = 0.001$). In contrast, BPL with β -value of 600 did not provide increased SUV_{max} for the lesions ≥ 10 mm in diameter.

Conclusion

BPL reconstruction significantly improves the detection of small inconspicuous malignant tumors in the lung, improving the diagnostic performance of PET/CT.