

Receiver operating characteristic (ROC) analysis of images reconstructed with iterative expectation maximization algorithms

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Purpose: The quality of images reconstructed by means of the maximum likelihood-expectation maximization (ML-EM) and ordered subset (OS)-EM algorithms, was examined with parameters such as the number of iterations and subsets, then compared with the quality of images reconstructed by the filtered back projection method.

Methods: Phantoms showing signals inside signals, which mimicked single-photon emission computed tomography (SPECT) images of cerebral blood flow and myocardial perfusion, and phantoms showing signals around the signals obtained by SPECT of bone and tumor were used for experiments. To determine signals for recognition, SPECT images in which the signals could be appropriately recognized with a combination of fewer iterations and subsets of different sizes and densities were evaluated by receiver operating characteristic (ROC) analysis. The results of ROC analysis were applied to myocardial phantom experiments and scintigraphy of myocardial perfusion.

Results: Taking the image processing time into consideration, good SPECT images were obtained by OS-EM at iteration No. 10 and subset 5.

Conclusions: This study will be helpful for selection of parameters such as the number of iterations and subsets when using the ML-EM or OS-EM algorithms.

Key words: maximum likelihood estimate-expectation maximization, ordered subsets-expectation maximization, receiver operation characteristics