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Evaluation of the role of system matrix in SPECT images reconstructed by OSEM technique

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View references (١٦)

Abstract

Introduction: Ordered subset expectation maximization (OSEM), is an effective iterative method for SPECT image reconstruction. The aim of this study is the evaluation of the role of system matrix in OSEM image reconstruction method using four different physical beam radiation models with three detection configurations. Methods: SPECT was done with an arc of ١٨٠ degree in ٣٢ projections after injection of ٢ mCi of ^{٩٩m}Tc-pertechnetate in a heart phantom by a Siemens E.Cam gamma camera equipped with LEHR collimator and data were transferred to a PC computer for reconstruction of the images with Mathlab software. The system or probability matrixes were firstly calculated using radiation fraction of pixels for three different detection models with linear, rectangular and divergent FOV, and reduction coefficient of photons from pixels to detectors in four different radiation models of distance independent (DID), inverse distance dependence (IDD) [≅١/R], inverse square distance dependence (ISDD),[≅١/$R^{٢}$] and inverse exponential distance dependence(IEDD),[≅exp-R]. In these calculations the detector was assumed at a distance of ٨٤٢ mm from the phantom center and pixel size was ٦,٦٣٨ mm. The divergent angle in divergent field of view was ٢,٠٨ degree. ١٢ Images of the phantom were reconstructed using system matrixes of ٤ different radiation and ٣ detection models. Qualities of the images were compared using universal image quality index, UIQI. Results: The results shows negligible although statistically significant difference between contrast and brightness of the images, but it is possible in the organs with constant absorption coefficients such as brain, to use the system matrix with mathematical IEDD radiation model for attenuation correction in SPECT images. It is shown that variation in distance weighting factors in mathematical IEDD radiation model changes the system matrix so that the weights of deeper data decrease in image reconstruction process. Therefore, by this method contrast of the image at different depth can be controlled. Conclusions: Applying different beam radiation models and detection configurations in system matrix has no significant improvements on the image quality. However image contrast at different depth can be controlled by using system matrix derived from different distance weighting factor in mathematical IEDD radiation model.

Reaxys Database Information

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Author keywords

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