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Preliminary evaluation of image reconstruction by ordered-subset expectation maximization in thallium-201 lung scintigraphy

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Objectives: We observed whether clearer tumor delineation and greater tumor to non-tumor (T/N) count ratios could be obtained using an iterative ordered-subsets expectation maximization (OSEM) algorithm than conventional filtered-back projection algorithm (FBP) in the image reconstruction of thallium-201 (^{201}Tl) lung scintigraphy. ***Methods:*** In 29 patients with lung cancer and phantom studies, tomograms were reconstructed using FBP and OSEM algorithms, with and without a prefilter (Butterworth filter: BW), whose cut-off frequencies were 0.10 cycles/pixel for FBP and 0.10 and 0.17 cycles/pixel for OSEM. Visual interpretation and tumor to non-tumor (T/N) count ratios were obtained and compared. ***Results:*** Without a prefilter, T/N ratios from OSEM and FBP were 1.89 ± 0.31 (early) and 2.00 ± 0.54 (late) for OSEM, 1.90 ± 0.33 (early) and 2.05 ± 0.59 (late) for FBP, respectively. The OSEM reconstruction without prefiltering showed clearer tumor contours than FBP without a prefilter. Incorporation of BW showed visually low-noised images but decreased T/N ratios in both reconstructions with BW (0.10 cycles/pixel). No greater T/N ratios were obtained by OSEM than FBP, with or without prefiltering. With BW with a cut-off frequency of 0.17 cycles/pixel, the same T/N ratios as those without BW were obtained. The tumor model sized 0.9 cm in the phantom study was invisible in both OSEM and FBP reconstructions without a prefilter, but visible with a prefilter. The influence of prefiltering on T/N ratios was also observed in phantom studies. ***Conclusions:*** Visually improved tumor delineation could be obtained in OSEM reconstruction without a prefilter as compared to FBP reconstruction without a prefilter for tumors greater than 2 cm. Prefiltering should be incorporated into OSEM reconstruction in diagnosing small tumors. However, the influence of prefilter (BW) setting on semi-quantitative interpretation needs further discussion.

Key words: ^{201}Tl scintigraphy, lung cancer, image reconstruction, OSEM algorithm