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Letter to the Editor

# Improved detection of sentinel lymph nodes in SPECT/CT images acquired using a low-to medium-energy general-purpose collimator: Reply To the Editor

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Short running head: Improved Detection of Sentinel Lymph Nodes Reply

We appreciate Dr.Ramin and colleagues for their interest in our study. When sentinel lymph nodes (SLNs) were not identified using any of planar imaging, SPECT/CT imaging and intra-operative $\gamma$-probe, axillary lymph node dissection cannot be avoided. Extensive axillary lymph node dissection is often associated with deterioration of quality of life in patients with breast cancer patients. Symptoms involving arms include lymphedema, pain, numbness, and restricted arm mobility, which are influenced by the extent of surgery in the axilla and the number of removed lymph nodes. Morbidity from axillary dissection can be decreased by limiting the extent of axillary lymph node dissection.[1-2] Since preoperative detection of SLNs permits surgeons to search nodes efficiently with the $\gamma$-probe, lymphoscintigraphy plays a role for providing accurate localizations.[3-4]

In this study, when SLNs could not be identified from planar and SPECT/CT images using the low-energy high-resolution (LEHR) collimator, we repeated the study with the low-to medium-energy general-purpose (LMEGP) collimator.[5] The surgeon might not be able to detect the SLNs using an intra-operative gamma probe, when additional study with the LMEGP collimator and could not detect the location. The resolution of LEHR collimator as assessed by full with at half maximum (FWHM) is 7.4mm, which was better than that of LMEGP collimator (10.4mm). In the planar images, the two neighboring lymph nodes are separable in the distance more than FWHM. As commented by Dr. Ramin et al, the number of detected SLNs on the lymphoscintigraphy images is considered important.[6] However, detectability of the SLNs is rather important than number of nodes. Although sentinel nodes close to each other can be identified separately using LEHR collimator and provide precise number of SLNs to the surgeon, the drawback of LEHR collimator is the appearance of star-shaped artifacts at the injection site.[7] The star-shaped artifacts were reduced using the LMEGP collimator, and detectability of SLNs, particularly located close to the injection sites, was improved. In our experience, the surgeon might find 2 or more SLNs, whereas scintigraphy detected only one SLN using LEHR collimator.[8] In this situation, the verification of the remaining nodes using $\gamma$-probe would be a practical approach. Moreover, multiple nodes near the possible sentinel nodes might be resected when we consider minor errors of localization. Recently, resolution correction (RC) has been performed for SPECT reconstruction.[9-11] We measured effect of resolution correction on SPECT images by line source phantom. The SPECT/CT system (Symbia T6; Siemens, Erlangen, Germany) was used for imaging. SPECT data were acquired using 128×128 matrix with pixel size of 4.8mm, 200kcounts/view and 60 frames with 6 degree step over 360 degrees. The energy was centered at 140keV with a 15% window for 99mTc. A

Gaussian filter was used for smoothing (FWHM: 9.6mm). Rotation radius was 25cm. The data of the line source was acquired and reconstructed with various updates (subset × iteration) and FWHM of SPECT images was measured for every collimator. Without resolution correction, LEHR collimator showed better FWHM. However, when resolution correction was applied, the resolutions of LMEGP and LEHR became similar (Fig.1). When high resolution is mandatory, planar images are acquired using both LEHR collimator and LMEGR collimator, and SPECT/CT images could be added using LMEGP collimator. This strategy is meaningful because it reduces the radiation dose from X-ray CT by repeated SPECT/CT studies.

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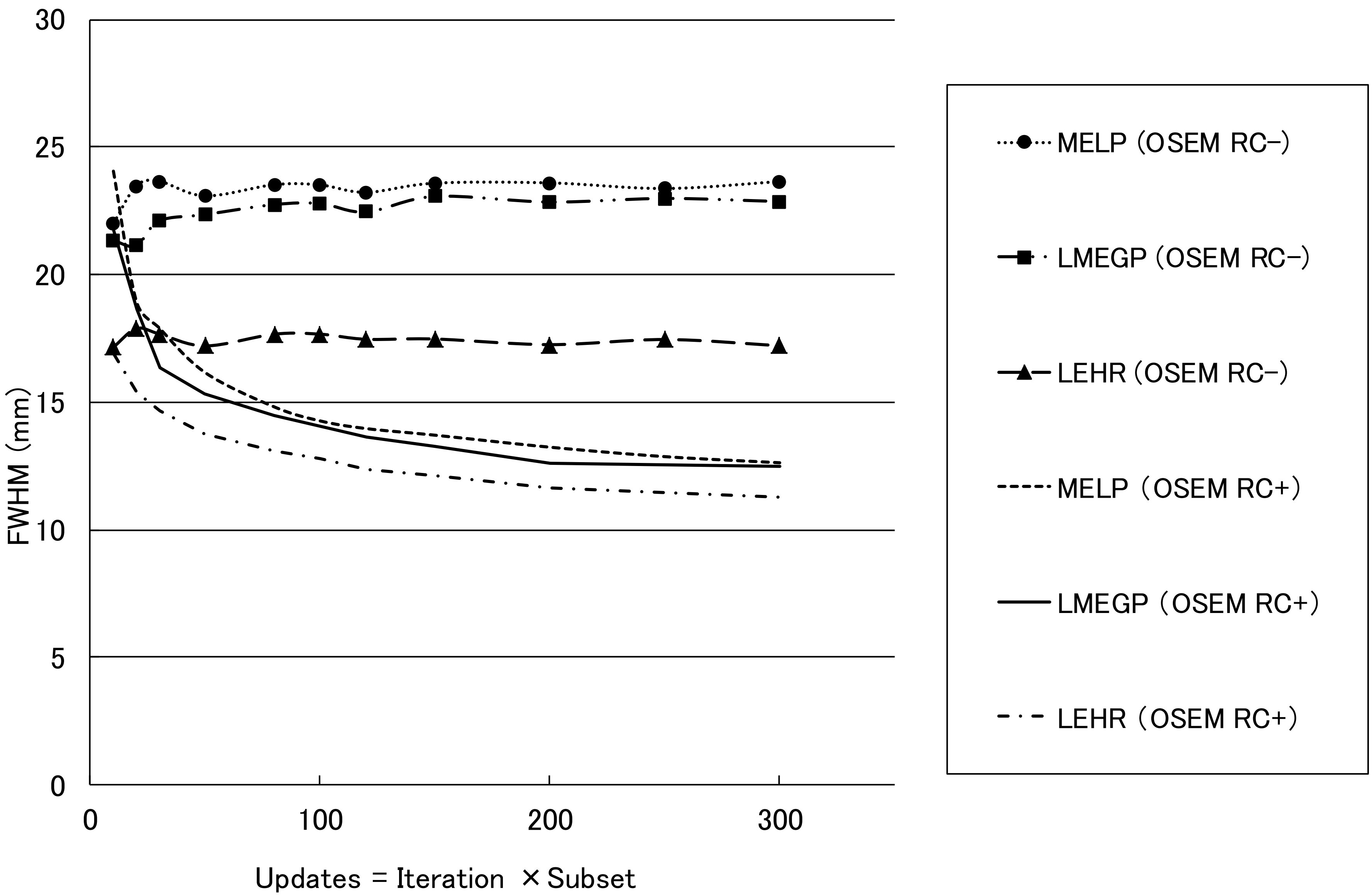
## Legends for illustrations

Figure 1　Effect of resolution correction on FHWM using LEHR, LMEGP and medium-energy low-penetration (MELP) collimators in SPECT images. FWHM is plotted in in various updates (subset×iteration) to ordered-subset expectation maximization algorithm (OSEM) reconstruction for each collimator.



30
25
20
15
10
5
0
FWHM (mm)
0
100
200
300
Updates = Iteration ×Subset
MELP (OSEM RC−)
LMEGP (OSEM RC−)
LEHR (OSEM RC−)
MELP (OSEM RC+)
LMEGP (OSEM RC+)
LEHR (OSEM RC+)


Fig. 1