

## Improved detection of axillary hot nodes in lymphoscintigraphy in breast cancer located in the upper lateral quadrant with additional projection imaging

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**Background:** Sentinel node (SN) biopsy has been becoming a standard method for early stage breast cancer. Scintigraphic image of SN helps the biopsy procedure. It is reported that the scintigraphic detection rate is not 100%. The value of taking additional projection view in SN detection was assessed in breast cancer patients. **Patients and Methods:** Consecutive 114 breast cancer patients with upper lateral quadrant tumor were included in this study. After injection of  $^{99m}\text{Tc}$ -phytate, scintigram was taken at the projection of anterior oblique (AO) 30° view and an additional AO 60° view. Images were evaluated visually. **Results:** In 7 of 114 patients, an axillary hot node was hidden on the activity at the injected site on AO 30° view, and was visualized on AO 60° view. In 17 of 114 patients, the axillary hot node was seen as a hump from the injected activity, and was separate on AO 60° view. In 90 of 114 patients, the axillary hot node was separately seen on AO 30° view. **Conclusion:** Multi-directional views are helpful to depict the axillary sentinel nodes that are concealed behind the injected radioactivity.

**Key words:** breast cancer, axillary sentinel node,  $^{99m}\text{Tc}$ -phytate, scintigraphy, multiple views

### INTRODUCTION

SENTINEL NODE (SN) biopsy using radiocolloid has been becoming a standard method for early stage breast cancer.<sup>1</sup> Scintigraphic images of sentinel node help the biopsy procedure. It is reported that the scintigraphic detection rate is not 100%.<sup>1,2</sup> There are many reasons why some patients show negative scintigraphic findings. One may be that the radioactivity accumulated in the sentinel node is concealed by the radioactivity at the injected site. This report shows that additional projection views enhance detection in breast cancer patients whose tumors located on the upper outer portion of the breast (C and C' territory).

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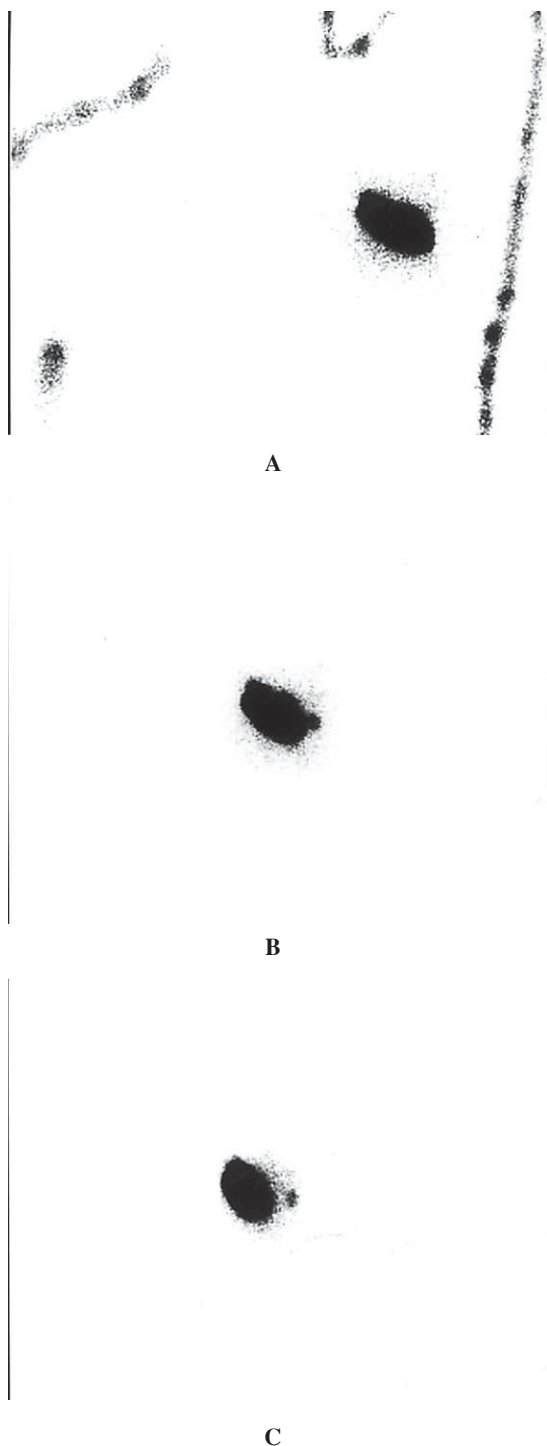
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### PATIENTS AND METHODS

#### *Procedure of sentinel node biopsy*

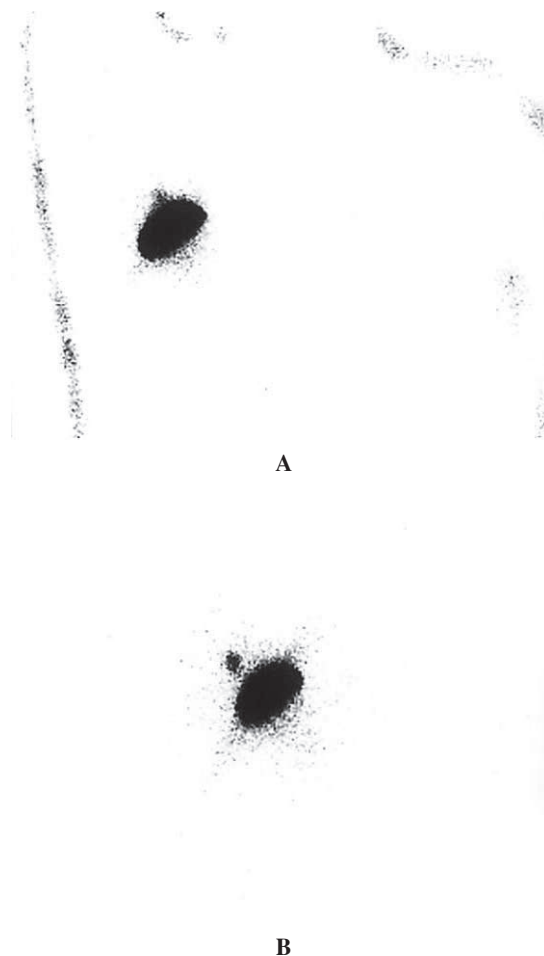
$^{99m}\text{Tc}$  phytate was used as a radiopharmaceutical for sentinel node detection of the breast.<sup>3</sup> A phytate kit (Daiichi Radioisotope Lab., Tokyo, Japan) to prepare  $^{99m}\text{Tc}$ -phytate was used according to the manufacturer's instructions. The  $^{99m}\text{Tc}$ -phytate was injected subcutaneously at 3 sites just above the breast tumor. Total injected volume was 1.0 ml, and each injection volume consisted of 0.3–0.4 ml. After injection, gentle massage on the injected sites was performed for 2 minutes. The radioactivity doses administered are 15 MBq for 1-day protocol and 56 MBq for 2-day protocol.<sup>4,5</sup> An Anger type gamma camera (FORTE, ADAC Laboratories, Milpitas, CA, USA) equipped with a low energy high resolution collimator was used to take the scintigraphic images, an anterior-oblique view (AO) 30° at 1 hour after the injection (data collection time = 120 sec).

An additional view of anterior oblique 60° (data collection time = 120 sec) was taken in consecutive 114 breast



**Fig. 1** Pattern-1 image: Figure 1A shows an image taken from left anterior oblique (AO) 30° view. Axillary hot node was completely concealed by radioactivity at injected sites. Axillary hot spot began to appear as a hump on left AO 60° view (Fig. 1B), and axillary hot spot could be separated from the injected site radioactivity on left lateral view (Fig. 1C).

cancer patients whose tumor was located in the upper lateral quadrant (C or C' region). Patients consisted of 113 female patients (age and SD; 53.7 and 13.7 years) and one



**Fig. 2** Pattern-2 image: Figure 2A shows a right AO 30° view, an axillary hot node visualized as a hump protruding from the injected radioactivity. On right AO 60° view, axillary hot node was seen as a separate hot spot from the injected site.

male patient (age; 52). When the angle was not sufficient to separate axillary nodes from the injected site radioactivity, lateral projection view was added.

## RESULTS

Axillary hot nodes were detectable on scintigraphic images in all 114 patients studied. The results of scintigraphy can be divided into three patterns: Pattern-1 is axillary hot node hidden on AO 30° view and visualized on AO 60° view as shown in Figure 1. Pattern-2 is axillary node partly visualized as a hump protruding from radioactivity at the injected site, and separated on AO 60° view. Pattern-3 is axillary SN seen on AO 30° view.

Figure 1 shows a pattern-1 image in which multi-direction images were helpful in detecting an axillary hot node. Figure 1A shows an image taken from left AO 30° view. The axillary hot node was completely concealed by radioactivity at the injected sites. The axillary hot spot began to appear on left AO 60° view (Fig. 1B), and the

**Table 1** Scintigraphic pattern of axillary hot nodes.

Pattern	Description	Number of cases	%	95% CI*
Pattern-1	Hidden on anterior oblique (AO) 30° view and visualized on AO 60° or lateral view.	7	6.1	(2.5–12.2)
Pattern-2	Axillary hot node was seen as a hump on AO 30° view and was separate from injected sites on AO 60° view.	17	14.9	(8.9–22.8)
Pattern-3	Axillary hot node was separately seen on AO 30° view.	90	79.0	(70.3–86.0)
Total		114		

\*: 95% confidential interval was calculated by a binominal method.

axillary hot spot could be separated from the injected site radioactivity on the left lateral view (Fig. 1C).

Figure 2 shows a pattern-2 image in which AO 60° view was helpful in detecting an axillary node. Figure 2A shows a left AO 30° view, an axillary hot node visualized as a hump protruding from the injected radioactivity. On left AO 60° view, the axillary hot node was seen as a separate hot spot from the injected site.

Table 1 summarizes the results of 114 patients. Pattern-1 was shown in 7 patients, pattern-2 in 17 patients, and pattern-3 in 90 patients. Therefore, 24 of 114 (21%) patients showed improved scintigraphic detection by adding the 60 degree view.

## DISCUSSION

Radio-guided SN detection in breast cancer is widely performed. Nuclear Medicine Departments play an important role in the procedure. However, in large studies, scintigraphic detection of axillary sentinel node was not 100%. In a multicenter study conducted by Krag,<sup>2</sup> 8 of 413 (1.9%) of such nodes were not identified underneath the injected hot spot. Veronesi reported that 8 of 649 (1.2%) showed no radioactive hot spot in the axilla on scintigram with anterior and anterior oblique view projections.<sup>1</sup> Borgstein et al. reported that sentinel node was detected during surgery in 17 of 220 (7.7%) of those whose sentinel node was scintigraphically negative. In this study, 7 of 114 (6.1%) of patients whose tumor was located in the upper lateral quadrant were undetectable in AO 30° view. In these patients, axillary hot node was revealed in anterior oblique 60° view or lateral view. Of course, concealment of the axillary hot node by the activity at the injected site is not the only reason for a scintigraphically negative study. However, there is no doubt that multi-direction views are helpful to depict the axillary SN that may be concealed behind the injected radioactivity.

The projection AO 45° view may depict higher percentage of axillary sentinel nodes. That means pattern-1 cases may be less if anterior oblique 45° view is used as a reference image. However, AO 30° view can depict parasternal SN more easily. Because 3 or 4 cases of

sentinel node detection procedure are performed in a single day, the scan-time of gamma-camera is limited. Anterior oblique 30° view is selected as a single scanning projection. When the tumors located in the upper lateral quadrant of the breast, an additional anterior oblique 60° view is routinely added.

Maza et al. reported that different injection techniques (per-tumoral and subaeolar) showed identical number and location of axillary SNs in 49 of 51 breast cancer patients.<sup>6</sup> They also reported the successful result of SN biopsy with subaeolar injection in 117 breast cancer patients.<sup>7</sup> It is proposed that all lymph channels of breast parenchyma and skin communicate in the subaeolar lymph plexus, and then lymphatic flow drains from the subaeolar plexus to axillary or parasternal lymph nodes.<sup>8,9</sup> Borgstein confirmed this contention by using vital dye and radioactive colloid, stating that the breast functions as a single biological unit, and the preferential lymph drainage pathway from all quadrants is essentially towards the same axillary sentinel lymph nodes.<sup>10</sup> Subaeolar injection may be another approach to avoid this problem (undetectable sentinel node underneath the injected radioactivity).

In conclusion, multi-direction views are helpful to depict axillary nodes in breast cancer when the tumor is located at the upper lateral region that may be concealed behind injected activity.

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