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The Effect of Portable Gamma Camera in Radioguided Lesion Localization and The Patient Management

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Abstract

Aim: The objective of this retrospective study is to analyze the efficiency additional portable gamma camera imaging in the evaluation of radioguided occult lesion localization (Roll).

Materials and Methods: Four female patients (44,75±13,25 years old) with occult breast lesions were included in the study. Roll by means of both gamma probe and portable gamma camera was performed during surgery. The pathological characteristics were analyzed and compared with the literature data.

Results: All of the patients had benign lesions according to the pathology results except for one patient who was indicated to excise additional tissue by the portable gamma camera which bearing microscopic intraductal papilloma focus.

Conclusion: In our series in one patient the portable gamma camera imaging revealed important additional information which changed patient management. We suggest additional portable gamma camera imaging during Roll procedures according to the results of this small case series.

1. Introduction

Radioguided occult lesion localization (Roll) procedures became routine in breast surgery recently (1) which includes injection of radiopharmaceuticals into the breast lesion by ultrasonography (US) guidance. These procedures might include simultaneous sentinel lymph node dissection procedures also which is called SNOLL. Especially when it is combined with sentinel lymph node imaging the method brought complete surgical removal in single surgery thus has benefits over the previous wire guided lesion localization method (2).

Radioguidance is performed by gamma probes which are portable devices for intraoperative applications. However, lack of image information in gamma probe guidance might have some handicaps.

A novel advancement in the Roll procedures is portable gamma cameras which has been used in different surgical procedures including sentinel lymph node imaging and parathyroid adenoma imaging successfully previously (3, 4). This method provides scintigraphy image during surgery and complete removal of activity at the surgery site after excision of the radiolabelled tissues.

There was only one study about the performance of portable gamma camera imaging in Roll procedures which showed benefits and feasibility of this method in a large series of patient group (5). We aimed to analyze the significance of the portable gamma camera imaging in the management of these patients in this study.

2. Materials and Methods

Four women (44,75±13,25 years old) with diagnosis of nonpalpable breast tumor were included in the study. The patients were considered to have T1-2 lesions according to TNM classification. Breast feeding and pregnant patients were excluded from the study.

3. Imaging procedure

The patients were informed about the procedure and informed consents of the patients were obtained. Intratumoral injection of approximately 5 mCi (185 MBq) Tc99m nanocolloid was performed by US guidance approximately one hour before the surgical procedure.

Additional standard gamma camera imaging was not performed during these procedures. Intraoperative estimation of the radioactivity was performed both by the gamma probe (Europrobe 3/Eurorad SA/France) and portable gamma camera (Crystal Cam; Dimensions: 65mm x 65mm x 180mm ; Detector: CdZnTe, 16 x 16 = 256 Pixel ; Detector Dimensions: 39.06mmx39.06mmx5mm ; Energy Range: 45 - 250keV ; Energy Resolution: <6% at 122keV, <5.5% at Tc-99m/ Deutschland). After removal of the radioactive tissues by guidance of both gamma probe and portable gamma camera the surgical bed was evaluated for residual radioactivity and re-operated if it is necessary. The images of the surgical area with and without tumor uptake and the surgical specimen were performed by the portable gamma camera. The additional time to obtain each image was approximately 10 minutes.

4. Pathology

Intraoperative pathology examination was not performed. The pathology results were analyzed with margin involvement estimation.

5. Results

The tumor characteristics and pathology results of the patients are summarized in Table 1. The portable gamma camera imaging depicted the lesions clearly and disappearance of the lesions were determined as well. All the radiolabeled breast lesions were excised successfully with clear surgical margins. Additional resection was necessary in one case (Figure 1) who documented to have additional microfocus of intraductal papilloma. Although gamma probe imaging also showed the lesions the second lesion would not be determined without portable gamma camera images.

The mean size of tumor by previous US imaging was 11,55±2,15 mm. Three patients had fibroadenoma and one patient had fibrocystic changes according to the pathology results.

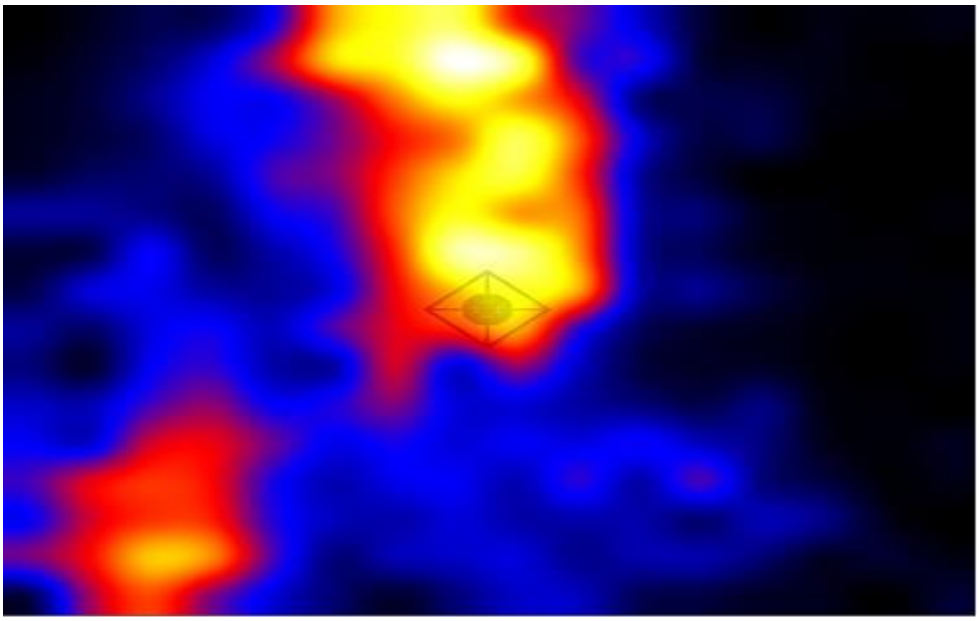

Figure 1: Portable gamma camera image of the breast lesion showing the two different uptake sites**.**

Table 1. Summary of tumor characteristics and pathology results of the patients

No of Patient	Localization	US size (mm)	Pathology	Pathology size (cm)	Margins
1.	Right/Clock 7	13x8	Fibrocystic changes	5x4x3	Negative
2.	Right/Clock 12	10x6	Fibroadenoma	8x6x1.5	Negative
3.	Right/Clock 7	10x6	Fibroadenoma, Intraductal papilloma	6x5x3 5x4x1	Negative Negative
4.	Right/Clock 9	14x7	Fibroadenoma	5x5x2	Negative

6. Discussion

There are several radiopharmaceuticals for Roll including intratumoral nanocolloid injection, intratumoral macroagregated albumin as well as injection methods including with or without additional intradermal nanocolloid injection for sentinel lymph node imaging. Recently intratumoral deposit injection is implicated in these procedures (6). In this study we preferred intratumoral nanocolloid injection however we did not perform additional sentinel lymph node imaging.

Roll procedures found to be highly effective and comfortable compared to other guided lesion localization procedures according to comparative studies (7). Roll has several superiorities over other procedures like better lesion centricity, lower volume of healthy tissue resection, and decrease in necessity of additional surgery, surgery time, and better cosmetic outcome (8, 9). Additionally, a previous study has shown that the dose of surgical procedures is only %10 of the dose limits (10). Bluemel et al. have reported high lesion detection rate of their study (97%) to be slightly lower than portable gamma camera procedures (97-99%) (11, 12) by 3D radioguided occult lesion localization. Additionally, it is possible to perform two different surgical procedures in a single session; sentinel node and Roll; SNOLL procedures; feasibility of this approach was reported by handheld gamma probe (99%) in a previous study (12).

Peredes et al. emphasized the fact that there is one problem about the Roll imaging which is the spilling of radiotracer within the mammary gland and suggested to obtain orthogonal planar views for this limitation (5). We also observed this finding during the operation and successfully excluded it by means of portable gamma camera images. The same observers reported a minor complication; needle line contamination during the Roll procedures as well (5). It has been suggested to give additional small volume of saline in this kind of situations (13). However, during the operation of one of our patients we observed the same finding and easily attributed to the needle line contamination by portable gamma camera. The same researchers also considered portable gamma camera imaging to have higher spatial resolution and similar sensitivity compared to gamma probe (5). However, we that portable gamma camera might change patient management as well. Peredes et al. emphasized the fact that guidance of portable gamma camera might lead to more distinct and smaller lesion resection with free margins (5) which was also commented in the application phase of this technique (14). We described that portable gamma camera imaging might contribute to patient management by determination surgical resection margins by showing additional lesions firstly in the literature.

Olcott et al. investigated additional benefits of handheld gamma camera compared to gamma probe in sentinel lymph node imaging and concluded that handheld gamma camera may not have compelling benefits for sentinel lymph node imaging and may be implicated in only difficult cases such as head and neck melanoma, or cancers with multiple nodal stations (15). The authors recommend handheld gamma camera for verification of removal of all radioactive focus because they found 12 additional nodes that were missed by gamma probe (15). In a recent review about the portable gamma camera applications in breast cancer have highlighted that intraoperative gamma camera imaging is beneficiary in sentinel lymph node imaging (16). Roll procedures are more complicated which may require special attention compared to sentinel lymph node excision. It is not standard to perform standard gamma camera imaging during Roll procedures and might not be applicable. These intraoperative imaging procedures might improve the detection of lesion and define the true robust margins of the lesion. However, it is not appropriate to suggest this because of the small sample size in this study. Other limitation of this study is the retrospective structure of the study. This study might be performed in larger group of patients in prospective studies. Lack of frozen section analysis may be considered another limitation.

7. Conclusion

Portable gamma camera applications might be beneficiary and can change patient management. In our small patient group, we observed that portable gamma camera imaging can determine the tumor borders more definitely compared to the gamma probe. The additional portable gamma camera imaging either decrease the

size of the lesion by excluding healthy tissue in resection material or more importantly contributed by determination of additional lesion and lead to the change in patient management.

Conflict of Interests

No conflict of interest was declared by the authors.

Financial Disclosure

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Author Contributions

Concept: Z.P.K.; Design: Z.P.K., G.Y.; Supervision: Z.P.K., P.P.O., Y.B., M.B., F.T.; Funding: Z.P.K.; Data Collection and/or Processing: Z.P.K.; Analysis and/or Interpretation: Z.P.K., P.P.O., Y.B., M.B., F.T.; Literature Review: Z.P.K.; Writer: Z.P.K., G.Y.

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