

Utility of Adding SPECT/CT Imaging to Post-Therapeutic Radioiodine Whole-Body Scan in Patients with Differentiated Thyroid Cancer

Jiraporn Sripraporn MD*, Chakmeedaj Sethanandha MD*,
Tawee Yingsa-nga MD*, Chulaluk Komoltri PhD**,
Thonnapong Thongpraparn MEng*, Chompunoot Harnnanthawiwat MSc*

* Department of Radiology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand

** Division of Research and Development, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand

Objective: To determine the usefulness of adding single-photon emission computed tomography/computed tomography (SPECT/CT) imaging to post-therapeutic radioiodine whole-body scan (RxWBS) in patients with differentiated thyroid cancer.

Material and Method: RxWBSs and SPECT/CT images of 93 consecutive patients were reviewed retrospectively by three experienced nuclear medicine physicians without knowledge of clinical data. RxWBSs were reviewed first followed by evaluation of RxWBS plus SPECT/CT imaging. Foci of increased radioiodine uptake were identified and localization was attempted. The findings obtained from RxWBS were compared with WBS plus SPECT/CT imaging to determine impact on lesion characterization, TNM staging, and management plan.

Results: Two hundred seventy seven lesions were identified by RxWBS alone. RxWBS plus SPECT/CT imaging detected eight additional pathologic lesions (4 in bones, two in neck, and one in lung and thyroid bed). RxWBS plus SPECT/CT studies reclassified 85 of 277 lesions (30.7%) detected by RxWBS. Most change occurred in neck region (57 lesions) followed by chest region (16 lesions). For impact on TNM staging, RxWBS plus SPECT/CT studies changed N stage of 21 patients (22.6%) and reclassified M stage of 10 patients (10.8%). These resulted in change of TNM stage group of 14 patients (15.1%) and changed management plan of 19 patients (20.4%).

Conclusion: The addition of SPECT/CT imaging to RxWBS in patients with differentiated thyroid cancer improved disease localization and lesion characterization leading to more accurate N and M staging, which was mainly downstaged. SPECT/CT also had impact on plan of management in about one fifth of the patients. However, caution should be taken when interpreting lesion in lower chest and upper abdomen because misregistration of SPECT and CT images.

Keywords: Radioiodine therapy, Single-photon emission computed tomography, SPECT/CT imaging, Radioiodine scan, Differentiated thyroid cancer

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Radioiodine whole-body scan (WBS) is an important imaging modality that has been used for staging, monitoring treatment response, and detecting recurrence in patients with differentiated thyroid cancer (DTC)⁽¹⁾. This imaging modality detects thyroid tissue remnant and foci of DTC with quite well performance. A sensitivity of 45 to 75% and a specificity of 90 to 100% have been reported for diagnostic planar WBS (DxWBS)⁽²⁾. The WBS performed two to 10 days after a therapeutic dose of radioiodine, called post-therapeutic planar WBS (RxWBS), has improved

sensitivity and has been reported to detect additional metastatic foci in 10 to 26% of DTC patients compared with DxWBS^(3,4). This results in disease stage alteration in about 10% of the patients⁽⁵⁾. However, RxWBS, similar to other functional imaging techniques, has some limitations in localization of lesions because not only it cannot accurately differentiate physiologic uptake in some areas from pathologic uptake but it also cannot precisely determine the location of pathologic lesions in some areas where potential metastatic sites are in close proximity such as peripheral parts of the lung and adjacent ribs. This is in part caused by the complexity of distribution of radioiodine in the body that resides in several compartments and chemical forms⁽⁶⁾. The nature of planar images also causes limitation in lesion localization and characterization.

Correspondence to:

Sethanandha C, Division of Nuclear Medicine, Department of Radiology, Faculty of Medicine Siriraj Hospital, 2 Prannok Road, Bangkoknoi, Bangkok 10700, Thailand.
Phone: +66-2-4196220-1, Fax: +66-2-4127165
E-mail: chakmeedaj.seh@mahidol.ac.th

Single-photon emission computed tomography (SPECT) has been developed to overcome the limitations of planar imaging. SPECT offers better image quality and higher sensitivity. It makes possible to create cross-sectional images of radioiodine distribution⁽²⁾. However, the lack of anatomical details still causes lesion localization and characterization difficult. With the invention of integrated SPECT/CT systems, which provides both anatomic mapping and functional imaging in one imaging session, it is now possible to determine the exact anatomic location of a focus of radioiodine uptake. Moreover, attenuation map derived from CT images can be used for attenuation correction of SPECT dataset, which potentially leads to further improvement in quality of SPECT images.

Aim of the present study was to determine whether adding SPECT/CT imaging to RxWBS improved lesion localization and characterization as well as had impact on clinical staging and plan of management.

Material and Method

Patients

Ninety-three consecutive patients (69 women and 24 men with a mean age of 50 years, range 18 to 88 years) with DTC (78 papillary carcinoma and 15 follicular carcinoma) who underwent both RxWBS and SPECT/CT imaging in the same session between December 2009 and September 2010 were retrospectively reviewed. All patients underwent total or complete thyroidectomy. All patients were instructed to consume low iodine diet for two weeks before radioiodine therapy. Thyroid-stimulating hormone (TSH) stimulation was obtained by withdrawing thyroid hormone medication for four weeks. In 87 of 93 patients, serum TSH level was over 30 mIU/L. Serum TSH level was less than 30 mIU/L in five patients who have functioning metastases. They received radioiodine therapy as scheduled because recombinant TSH was not available. Patient demographics were summarized in Table 1. The study was approved by the Siriraj Institutional Review Board.

Imaging protocol

RxWBS was performed in both anterior and posterior projections at 72 hours after oral administration of predetermined therapeutic radioiodine dose (3.7 GBq in 1 patients, 5.6 GBq in 78 patients, and 7.4 GBq in 14 patients) using dual-head gamma camera

(Symbia T2, Siemens Medical Solutions) equipped with parallel-hole, high-energy collimators, using a 20% energy window with photopeak at 364 keV. The table speed for the whole-body imaging was 15 cm/min (256x1,024 matrix size). Static images were acquired for 20 minutes using a 256x256 matrix size.

SPECT imaging and CT scan were performed in the same session as RxWBS over the region where there was potential pathologic uptake seen on RxWBS images. The patients were in the same position during RxWBS, SPECT imaging, and CT scan.

SPECT imaging was performed over 360° (180° per head) at the same photopeak and energy window as RxWBS. A 128x128 matrix was used with a 3° angular step and an acquisition time of 30 seconds per frame. SPECT images were reconstructed using the iterative method and a CT-based attenuation correction algorithm was applied. CT scan was performed after SPECT imaging operating at 130 kVp and 80 mAs. CT reconstruction was performed at 4-mm slice thickness into a 512x512 matrix. SPECT images were fused with CT images using a dedicated software package (eSoft processing software on a Syngo workstation, Siemens Medical Solutions).

Data analysis

RxWBS images were reviewed on a Syngo workstation by three experienced nuclear medicine physicians who were blinded to the clinical findings, other diagnostic imaging results and definitive histopathologic diagnosis. Increased radioiodine uptake was defined as any focal or diffuse radioactivity accumulation that was higher than the surrounding background activity. Areas of increased radioiodine

Table 1. Patient characteristics

Clinical characteristics	Values
Number of patients, n (%)	93
Female	69 (74.2)
Male	24 (25.8)
First radioiodine therapy	33 (35.5)
More than one radioiodine therapy	60 (64.5)
Age (years)	
Mean	50
Range	18-88
Histology, n (%)	
Papillary	78 (83.9)
Follicular	15 (16.1)
Range of radioiodine doses administered (GBq)	3.7-7.4

uptake were then classified according to their location and nature as 1) remnant thyroid tissue or residual tumor in the surgical thyroidectomy bed, 2) thyroglossal duct remnant, 3) cervical lymph node metastasis, 4) mediastinal lymph node metastasis, 5) lung metastasis, 6) osseous metastasis, 7) other distant metastases, and 8) physiologic distribution. Plan of management based on RxWBS alone was determined when the review was finished for each patient. The results were recorded after consensus on image interpretation and management plan was reached. Subsequently, interpretation of RxWBS plus SPECT/CT imaging was performed by the same observers. Each lesions found on RxWBS images were reclassified regarding their location and nature seen when SPECT/CT images were available. Plan of management based on the results obtained from RxWBS plus SPECT/CT imaging was also determined. Disagreement in both interpretation sessions was resolved by consensus.

After the analysis of RxWBS plus SPECT/CT imaging was finished. Clinical, laboratory, pathologic and radiological data available prior to the imaging session were revealed and then, based on these data and RxWBS images alone, staging using American Joint Committee on Cancer (AJCC) TNM system (seventh edition) was attempted⁽⁷⁾. Subsequently, another set of TNM staging was determined using clinical information and data derived from RxWBS plus SPECT/CT imaging.

Number and percentage of the lesions reclassified by SPECT/CT images were analyzed. Differences of TNM staging and plan of management provided by RxWBS images alone and derived from RxWBS plus SPECT/CT imaging were also analyzed.

Results

RxWBS showed 277 foci of pathologic increased radioiodine uptake in 93 patients, who were also depicted on SPECT/CT images. Of these, 151 foci were in the neck, 71 foci were in the thorax, five foci were in the abdomen or pelvis, and 50 foci were determined to be osseous metastases.

RxWBS plus SPECT/CT imaging revealed 285 pathologic foci, 277 of which were detected by RxWBS. There were eight additional pathologic lesions, five of which were considered to be physiologic foci on RxWBS images and the other three lesions were not depicted on RxWBS images. Globally SPECT/CT reclassified 85 of 277 lesions (30.7%)

found by RxWBS. Two other lesions were considered to be physiologic uptake by RxWBS, which were characterized as pathologic lesions, not related to thyroid cancer by SPECT/CT.

In the neck, RxWBS detected 151 lesions, 78 were classified as uptake in the thyroid bed (69 foci) or in thyroglossal tract (7 foci), and 75 were considered to be cervical lymph node metastasis. SPECT/CT reclassified 21 of 69 lesions (30.4%) in thyroid bed to be cervical lymph node metastasis (18 lesions), physiologic uptake (2 lesions) and bone (1 lesion). Moreover, 36 of 75 lesions (48%) in cervical lymph nodes were showed to be in thyroid bed (18 lesions), thyroglossal tract (10 lesions), physiologic uptake (6 lesions) (Fig. 1), mediastinal lymph node (1 lesion), and bone (1 lesion). Fifty-seven of 151 lesions (37.7%) in the neck were reclassified.

In the thorax, RxWBS identified 71 pathologic lesions, 53 were considered to be lung metastasis and 18 were classified as mediastinal lymph node metastasis. SPECT/CT reclassified eight of 53 lung lesions (15.1%) to be mediastinal lymph node (3 lesions) (Fig. 2), bone (3 lesions), and pathologic uptake of non-thyroid origin (2 lesions). Eight of 18 lesions were changed from mediastinal lymph node metastasis to be physiologic uptake (4 lesions), lung metastasis (2 lesions), cervical lymph node (1 lesion), and osseous metastasis (1 lesion). Sixteen of 71 lesions (22.5%) were reclassified in the thorax.

There were 50 lesions of osseous metastases detected by RxWBS, 42 of which were in concordance with SPECT/CT images. Eight of 50 lesions (16%) were reclassified, five were physiologic uptake, two were lung metastasis, and one was cervical lymph node metastasis.

Based on RxWBS images, there were five suspicious lesions in the abdomen or pelvis. Four of five lesions (80%) were reclassified by SPECT/CT, two were actually foci of lung metastasis, one was physiologic uptake, and the other one was uptake in uterine cervix. For the remaining one lesion, SPECT/CT could confirm its location at left adrenal gland, where metastasis could not be excluded, so this was noted as concordance lesion in RxWBS and SPECT/CT imaging (Fig. 3).

SPECT/CT detected eight additional pathologic lesions, five of these were considered to be of physiologic by RxWBS but SPECT/CT reclassified them as osseous metastasis (3 lesions), cervical lymph node metastasis (1 lesion), and uptake in thyroid bed (1 lesion). The other three lesions were seen only on

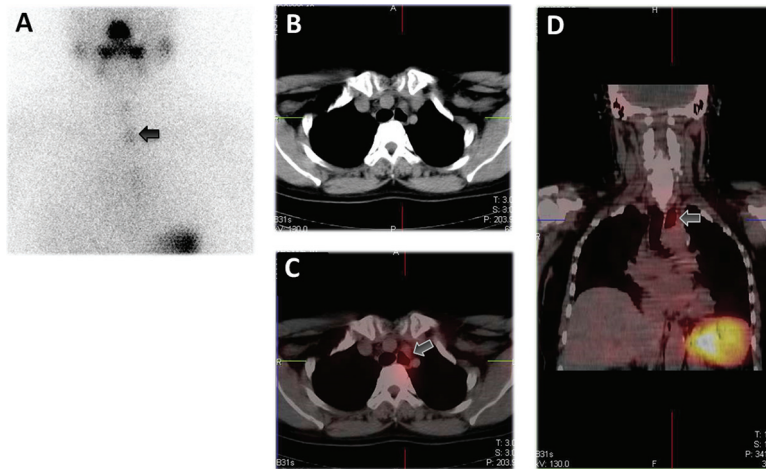


Fig. 1 A 65-year-old woman with thyroidectomized follicular thyroid carcinoma 72 hours after administration of third therapeutic dose of radioiodine therapy. RxWBS in anterior view (A) defined a focus at lower neck (arrow) as lymph node metastasis in group VI cervical region. However, there was no anatomical abnormality on a low-dose CT image (B). On SPECT/CT fused images in axial (C) and coronal (D) slices, the lesion actually located in esophagus. This change resulted in downstaging of N stage from N1a to N0.

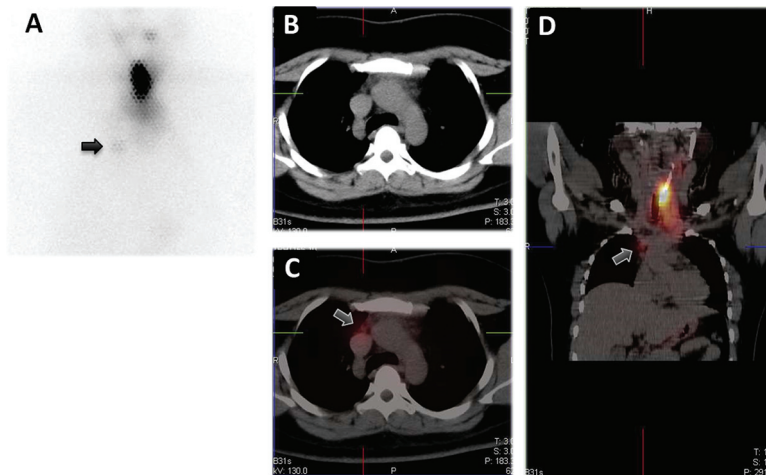


Fig. 2 A 31-year-old woman with thyroidectomized papillary thyroid carcinoma 72 hours after administration of a therapeutic dose of radioiodine for remnant ablation. RxWBS in anterior view (A) reveals a focus of radioiodine uptake at right paramedian aspect of upper thorax which was thought to represent a focus of lung metastasis. Low-dose CT image (B) and fused images in axial and coronal slices (C, D) derived by SPECT/CT imaging showed that the uptake was in a small lymph node at right side of upper mediastinum so mediastinal lymph node metastasis was considered. This reclassification changed M stage from M1 to M0 and N stage from N0 to N1b as well as TNM stage group from stage II to stage I.

SPECT/CT images at cervical lymph node, lung, and bone. Moreover, SPECT/CT was able to identify two pathologic lesions that were not related to thyroid cancer including uptake in uterine cervix due to chronic cervicitis with squamous metaplasia and enlarged uterus without radioiodine uptake due to hydrometra. The results were summarized in Table 2.

For N stage, RxWBS determined that 14 patients had N0 stage. Two of 14 patients (14.3%) were upstaged by SPECT/CT imaging, one was upstaged to be N1a and the other one was upstaged to be N1b. There were 11 of 23 patients (47.8%) with stage N1a based on RxWBS, which were downstaged (6 patients) and upstaged (5 patients) by SPECT/CT

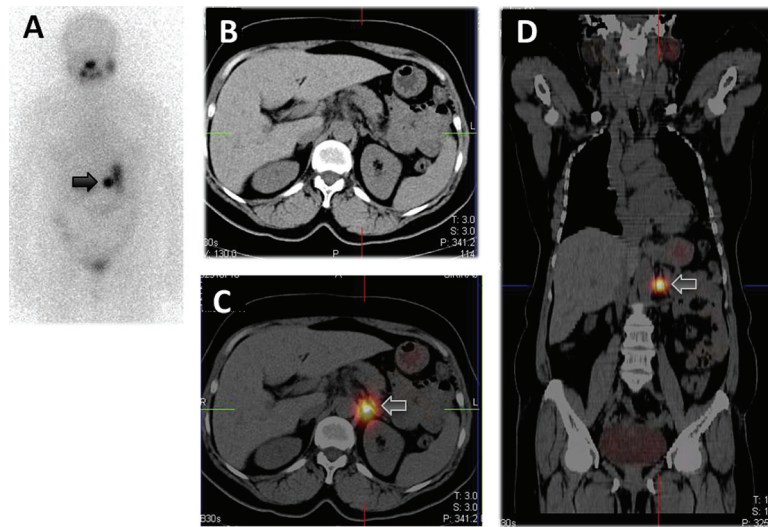


Fig. 3 A 60-year-old woman with thyroidectomized papillary thyroid carcinoma 72 hours after second therapeutic dose of radioiodine therapy. RxWBS in anterior view (A) showed a discrete focus of radioiodine uptake in left upper quadrant of abdomen. SPECT/CT imaging (B-D) helped localize the lesion to anatomically unremarkable left adrenal gland. After 11-months follow-up, DxWBS with SPECT/CT found no evidence of radioiodine uptake at left adrenal gland and stimulated thyroglobulin level was lower than 1 ng/mL.

imaging. Of 56 patients with N1b stage by RxWBS, eight of them (14.3%) were downstaged by SPECT/CT imaging; six patients were reclassified as N0 stage and the other two were downstaged to N1a. Twenty-one of 93 patients (22.6%) had their N-stage changed by SPECT/CT imaging.

For M stage, RxWBS classified 46 patients as M0 stage and the other 47 as M1 stage. SPECT/CT upstaged two of 46 patients (4.3%) and downstaged in eight of 47 patients (17%). Overall change in M-stage by SPECT/CT imaging was 10.8%.

For TNM stage grouping, there were 21 patients who had stage I based on RxWBS. One of them, who was younger than 45-year-old, was upstaged to stage II because SPECT/CT found distant metastasis. Five of 18 patients with stage II were downstaged to stage I by SPECT/CT. Five patients were stage III, and one of them was downstaged to stage I by SPECT/CT. Two of 19 patients with stage IVA by RxWBS had their stage changed by SPECT/CT; one was upstaged to stage IVC and the other was downstaged to stage I. RxWBS diagnosed stage IVC in 30 patients; five of

Table 2. Evaluation of the data on a lesional basis

Lesion location	Reclassified	RxWBS lesions	Impact
Overall	85	277	30.7%
Loco-regional			
Thyroid bed	21	69	30.4%
Thyroglossal duct remnant	0	7	0.0%
Cervical lymph node	36	75	48.0%
Total	57	151	37.7%
Distant			
Mediastinal lymph node	8	18	44.4%
Lung	8	53	15.1%
Skeleton	8	50	16.0%
Abdominal organs	4	5	80.0%
Total	28	126	22.2%

RxWBS = post-therapeutic radioiodine whole-body scan

Table 3. Impact of additional SPECT/CT imaging on TNM staging and clinical management

Impact of SPECT/CT imaging	
N stage	
Upstage	7/93 (7.5%)
Downstage	14/93 (15.1%)
Total change	21/93 (22.6%)
M stage	
Upstage	2/93 (2.2%)
Downstage	8/93 (8.6%)
Total change	10/93 (10.8%)
TNM stage group	
Upstage	2/93 (2.2%)
Downstage	12/93 (12.9%)
Total change	14/93 (15.1%)
Clinical management	19/93 (20.4%)

SPECT/CT = single-photon emission computed tomography/computed tomography

them were downstaged by SPECT/CT to stage IVA. Overall TNM stage group was changed by SPECT/CT in 14 of 93 patients (15.1%).

The findings provided by RxWBS plus SPECT/CT imaging led to change in management plan of 19 of 93 patients (20.4%). In 13 patients, SPECT/CT identified new lesions that were unexpected or would impact staging and clinical decision so further investigation was planned instead of regular follow-up. Potentially resectable lymph nodes were detected by SPECT/CT imaging in three patients so they were sent for surgical consultation. SPECT/CT images obviate the need for further investigation in three patients. Table 3 summarized impact of SPECT/CT on TNM staging and clinical management.

Discussion

RxWBS is recommended for use in patients with DTC receiving a therapeutic dose of radioiodine⁽⁸⁾. With larger dose of radioactivity, RxWBS generally performs better than DxWBS^(3,4). However, the interpretation of the images provided by RxWBS is quite challenging. Not only the readers need to have profound knowledge about complex distribution of radioiodine in the body but they also need to accumulate quite a lot of experience in order to be able to interpret RxWBS images accurately⁽⁶⁾. Despite this, there are still many foci of increased radioiodine uptake that experienced readers cannot precisely and confidently determine their nature and are left marked as equivocal lesions. Most of these are resulted from the lack of

anatomical details provided on the images, which is one of the main problems in interpretation of functional imaging. The recent advances made integrated SPECT/CT system widely available. The integrated SPECT/CT system can acquire data for generating both functional images and anatomical images from the patient in the same position, which allows very accurate coregistration of functional data to anatomical map^(9,10). The addition of SPECT/CT imaging to conventional RxWBS provides the readers with cross-sectional images of radioiodine distribution on the anatomic map created by CT scan, which would help them to localize and characterize foci of radioiodine uptake more precisely.

In the present study, SPECT/CT globally changed lesion localization in 30.7% of lesions detected by RxWBS, which was in concordance with the findings of the previous studies⁽¹¹⁻¹³⁾.

SPECT/CT performed best in the neck region where it reclassified 37.7% of lesions, which was slightly more than what reported by Kohlfuerst et al, that SPECT/CT improved localization in 28.9% of lesions in the neck⁽¹¹⁾. The reason that SPECT/CT was very helpful in this region was that RxWBS could not accurately differentiate uptake in thyroid bed from that in regional cervical lymph node. In the present study, 30.4% of foci at thyroid bed on RxWBS were actually cervical lymph node metastases and this caused upstaging of N stage in 7.5% of patients. On the other hand, 48% of lesions thought to be cervical lymph node metastases based on RxWBS were actually something else; mainly thyroid bed uptake followed by thyroglossal duct remnant. Apart from difficulty in distinguishing uptake in thyroid bed from cervical lymph node, the interpretation may be confounded by physiologic uptake, which was accounted for 5.3% of lesions misclassified by RxWBS. The main confounder was the retained radioiodine-containing saliva in esophagus, which sometime mimicked uptake in thyroid bed or lymph node. As per patient basis, improved localization and characterization by SPECT/CT led to change in N stage of 22.6% of patients. The change in N staging in the present study was relatively lower than those reported in the previous studies which varied from 35% to 36.4%^(11,14). The possible reasons were that, in the present study, there were higher proportion of patients whom underwent two or more radioiodine therapy sessions and all patients were recruited when their images had possible inconclusive findings.

There were 22.5% of lesions in the thorax that were reclassified. In this region, most of the problems

were related to characterization of mediastinal lymph node metastasis. The 44.4% of lesions marked as foci in mediastinal lymph node were reclassified because planar images derived from RxWBS could not accurately differentiate uptake in mediastinal lymph node from retained activity in thoracic esophagus, uptake in thymus as well as adjacent lung and skeletal structures. Moreover, 15.1% of lesions classified as lung metastasis were actually metastasis in bones or mediastinal lymph nodes or non-thyroid-related pathology. Confusion between peripheral lung lesions and bone lesions and between uptake in medial aspect of lung and mediastinal lymph node were caused by the proximity of these structures. This was characterized much easier on SPECT/CT images. Moreover, radioiodine accumulation in other lung pathologies not related to thyroid cancer was very hard to distinguish from lung metastasis without the use of SPECT/CT.

For the evaluation of osseous metastasis, RxWBS performed quite well with 16% of these were reclassified by SPECT/CT. It should be noted that uptake in cervical lymph node, lung and pelvic organs, such as uterine cervix, uterus and rectum, could potentially be mistaken with osseous metastasis.

It was rare to detect metastasis in abdomen and pelvis. In the present study, there were only five potential pathologic lesions accounted for 1.8% of all lesions detected by RxWBS. Four of them were characterized otherwise by SPECT/CT. One potential lesion in left upper quadrant was at left adrenal gland without definite anatomical abnormality on CT images. According to the literatures⁽¹⁵⁻¹⁹⁾, this may represent either adrenal metastasis or ectopic thyroid tissue in adrenal gland. The patient was sent for diagnostic adrenal CT scan but no CT abnormality was detected at left adrenal gland so surgery was not performed. The uptake disappeared in DxWBS performed 11 months after the treatment so no definite diagnosis can be made for the etiology of this lesion (Fig. 3).

The improved image quality and better localization provided by SPECT/CT not only led to change in N stage but also reclassified M stage in 10.8% of patients. TNM stage group was also changed in 15.1% of patients. The impact was relatively lower compared to what reported in the prior studies^(11,14). Fourteen of 21 patients (66.7%) who had their N stage reclassified as well as 12 of 14 patients (85.7%) who had their M stage changed were downstaged to lower N stage and M stage, respectively.

SPECT/CT had impact on plan of management in 20.4% of patients, which was comparable with the

previous studies that reported impact in the range of 23.4 to 25% of the patients⁽¹¹⁻¹³⁾.

Despite great performance in disease localization and characterization, SPECT/CT imaging has some limitations. The time required for SPECT imaging is relatively long; with the protocol used in the present study, it takes at least 30 minutes to finish SPECT imaging of one region. Moreover, it would be impossible to know how many patients would require SPECT/CT imaging so it is hard to set an appropriate workflow that could accommodate the uncertainty of the need of SPECT/CT imaging. Ability to localize and characterize lesions of SPECT/CT rely mainly on performance of low-dose non-enhanced CT scan, which would be limited by altered anatomy resulted from prior treatment and beam-hardening artifact. SPECT/CT also relies on ability of radioiodine to detect foci of DTC so it would be limited for accurate evaluation of non-radioiodine-avid DTC. Although SPECT and CT images are acquired when patients are in the same position, misregistration may still occur in the regions relating to respiratory motion such as ribs, lung bases, liver, adrenal glands, and kidneys. SPECT/CT exposes patients to additional radiation from CT scan. According to Buck et al, a patient would receive radiation dose of 2-4 mSv from low-dose CT scan of one region⁽²⁰⁾, which would be about 0.5 to 1% of effective dose caused by 3.7-GBq radioiodine therapy (ICRP 53)⁽²¹⁾. Low-dose CT images may reveal many normal anatomical variations as well as non-radioiodine-avid anatomical abnormalities, which may lead to unnecessary further investigation and anxiety if interpreted by inexperienced reader.

Limitation of the present study was that it was retrospective review. Many lesions that were reclassified by SPECT/CT were not able to be confirmed pathologically, so without proper reference standard, formal diagnostic accuracy such as sensitivity and specificity could not be calculated. However, the present study would serve well as basis for designing and determining direction of further prospective studies.

Conclusion

The addition of SPECT/CT imaging to RxWBS in patients with DTC improved disease localization and lesion characterization leading to more accurate N and M staging. Majority of the patients had their N or M stage reclassified as downstaged. SPECT/CT also had impact on plan of management in about one fifth of the patients. However, caution should

be taken when interpreting lesion in lower chest and upper abdomen because misregistration of SPECT and CT images due to respiration often occurred.

What is already known on this topic?

Radioiodine whole-body scan is current standard modality for staging and monitoring treatment response in patient with DTC. RxWBS is known to have superior diagnostic accuracy as well as impact on clinical management compared to DxWBS⁽³⁻⁵⁾, so it is recommended to perform after each radioiodine therapy⁽⁸⁾. However, images provided by RxWBS have the same limitations as other functional imaging techniques that are lack of anatomical details. These complicate interpretation of RxWBS result because a focus of radioiodine accumulation may represent several etiologies ranging from normal physiologic process to metastatic focus as well as many others in between. Methods that could help differentiate nature of a radioiodine accumulation are needed to further improve performance of RxWBS.

SPECT/CT imaging is an emerging hybrid imaging modality that provides precise coregistration of SPECT images and CT images, which acquired sequentially with the patient staying in the same position. Fused SPECT/CT image maps a lesion in SPECT study onto anatomical image depicted by CT study resulting in improved anatomical localization and better lesion characterization. Moreover, CT images used for attenuation correction during SPECT image reconstruction also improve quality of SPECT images. However, the data about performance of adding SPECT/CT imaging to RxWBS is limited.

What this study adds?

The results of the present study showed that addition of SPECT/CT imaging to RxWBS improved disease localization and lesion characterization in about one third of the patients. Reclassification of N stage happened in about one fifth of the patients and about 10% of the patients had their M stage reclassified. Type of reclassification tended to be downstaged in majority of the patients. These resulted in change in plan of management in 20.4% of the patients.

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Potential conflicts of interest

None.

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ประโยชน์ของการเพิ่มการถ่ายภาพ SPECT/CT ในการตรวจสแกนทั่วตัวหลังการรักษาด้วยไอโอดีนรังสีในผู้ป่วยมะเร็งไทรอยด์ชนิด *differentiated*

จิราพร ศรีประภาภรณ์, จักรมีเดช เศรษฐนันท์, ทวี ยิ่งสง่า, จุฬาลักษณ์ โกมลตรี, ธนพงษ์ ทองประพาพ, ชมพูนุช หาญนันท์วิวัฒน์

วัตถุประสงค์: เพื่อประเมินประโยชน์ของการเพิ่มการถ่ายภาพ SPECT/CT ในการตรวจสแกนทั่วตัวหลังการรักษาด้วยไอโอดีนรังสีในผู้ป่วยมะเร็งไทรอยด์ชนิด *differentiated*

วัสดุและวิธีการ: ภาพสแกนทั่วตัวหลังการรักษาด้วยไอโอดีนรังสีและภาพจากการถ่ายภาพด้วยวิธี SPECT/CT ของผู้ป่วย 93 ราย ได้รับการแปลผลโดยแพทย์เวชศาสตร์นิวเคลียร์ที่มีประสบการณ์ 3 คน โดยไม่ทราบข้อมูลทางคลินิกของผู้ป่วย เริ่มต้นด้วยการแปลผลภาพสแกนทั่วตัวอย่างเดี่ยวก่อนแล้วตามด้วยการแปลผลภาพสแกนทั่วตัวร่วมกับภาพจาก SPECT/CT ผู้แปลผลจะพยายามระบุตำแหน่งของรอยโรคที่มีการอักเสบของไอโอดีนรังสีเพิ่มขึ้น นำข้อมูลที่ได้จากภาพสแกนทั่วตัวไปเปรียบเทียบกับข้อมูลที่ได้จากภาพสแกนทั่วตัวร่วมกับภาพ SPECT/CT เพื่อประเมินอิทธิพลต่อการบอกลักษณะรอยโรค TNM staging และการวางแผนการรักษา

ผลการศึกษา: ภาพสแกนทั่วตัวอย่างเดี่ยวตรวจพบรอยโรคทั้งหมด 277 รอยโรค ส่วนภาพสแกนทั่วตัวร่วมกับภาพ SPECT/CT พบรอยโรคเพิ่มเติม 8 รอยโรค (4 รอยโรคในกระดูก 2 รอยโรคในคอ 1 รอยโรคในปอด และ 1 รอยโรคที่ thyroid bed) ภาพสแกนทั่วตัวร่วมกับภาพ SPECT/CT ทำให้เกิดการเปลี่ยนแปลงใน 85 รอยโรค จาก 277 รอยโรค (ร้อยละ 30.7) ที่พบในภาพสแกนทั่วตัว การเปลี่ยนแปลงส่วนใหญ่เกิดขึ้นในบริเวณคอ (57 รอยโรค) ตามด้วยบริเวณทรวงอก (16 รอยโรค) สำหรับผลต่อ TNM staging ภาพสแกนทั่วตัวร่วมกับภาพ SPECT/CT สามารถเปลี่ยน N stage ของผู้ป่วย 21 ราย (ร้อยละ 22.6) และเปลี่ยน M stage ของผู้ป่วย 10 ราย (ร้อยละ 10.8) ซึ่งมีผลทำให้เกิดการเปลี่ยนแปลงของ TNM stage ของผู้ป่วย 14 ราย (ร้อยละ 15.1) และการเปลี่ยนแปลงของแผนการรักษาของผู้ป่วย 19 ราย (ร้อยละ 20.4)

สรุป: การเพิ่มการถ่ายภาพ SPECT/CT ในการตรวจสแกนทั่วตัวหลังการรักษาด้วยไอโอดีนรังสีในผู้ป่วยมะเร็งไทรอยด์ชนิด *differentiated* ทำให้ระบุตำแหน่งทางกายวิภาคและแยกแยะลักษณะของรอยโรคได้ดีขึ้น นำไปสู่การประเมินระยะโรคที่แม่นยำมากขึ้นซึ่งส่วนใหญ่จะเป็นการเปลี่ยนระยะโรคไปสู่ระยะที่ต่ำกว่า SPECT/CT ยังมีผลต่อแผนการรักษาของผู้ป่วยประมาณหนึ่งในห้ารายอีกด้วย อย่างไรก็ตามควรใช้ความระมัดระวังในการแปลผลรอยโรคที่อยู่บริเวณทรวงอกส่วนล่างและช่องท้องส่วนบน เพราะมักเกิดการระบุตำแหน่งของรอยโรคในภาพ SPECT บนภาพ CT ผิดพลาดจากการหายใจเกิดขึ้นได้บ่อย
