

Comparison of Whole Body ¹³¹Iodine Scan Results in Four, Seven and Nine Days after Radio-iodine Therapy of Differentiated Thyroid Cancer

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ARTICLE INFO	ABSTRACT
<p><i>Article type:</i> Original article</p> <hr/> <p><i>Article History:</i> Received: 09-Jan-2019 Accepted: 08-Apr-2019</p> <hr/> <p><i>Key words:</i> Differentiated thyroid cancer Iodine Radio Whole body I131 scan</p>	<p>Introduction: finding optimum time of post ablation whole body iodine scan in patients with differentiated thyroid cancer(DTC) treated with I-131.</p> <p>Materials and Methods: 20 patients with DTC, who were treated with ¹³¹I undergone post ablation whole body iodine scan (WBIS) in days 4, 7 and 9 after treatment. A dual head gamma camera (e-cam, Siemens) equipped with high energy parallel hole collimator was used for imaging. The images were acquired with 7cm/min and stored in a 1024 × 256 matrix.</p> <p>Results: 3 patients had negative WBIS in all three sets of imaging and 17 patients had postsurgical thyroid remnants on all 3 scans. On days 4 and 7 we detected 11 patients with cervical lymph node metastases while on day 9 only 9 patients showed cervical lymph node metastases. (P=0.135). On all 3 sets of images, we encountered 4 patients with mediastinal lymph node metastases and 1 patient with bone metastasis. In addition, all 3 sets of images detected lung metastases in three patients. The total number of affected foci did not have any statistical differences in whole body scan of day 4, 7 and 9. (P = 0.083)</p> <p>Conclusion: according to the radiation safety hazards for staff and technicians of nuclear medicine department and lack of difference in scan findings between 4 and 7 days after RAI, scanning the DTC patients in the day 7 after RAI administration , is more practicable, with less probability of missing the sites of involvement.</p>
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Introduction

Differentiated thyroid cancer (DTC) is the most common endocrine malignancy and its incidence has been increasing in the last 30 years (1-5). Thyroid surgery (near total or total thyroidectomy), followed by radioiodine ablation is considered as the main treatment options in patients with DTC (6, 7). Radio-iodine therapy is one of the cornerstones of treatment in differentiated thyroid cancer patients, increasing the overall survival rate (8-13). RIA is usually followed by suppressive therapy with thyroid hormones and periodic survey for recurrence of the disease in a lifelong followup

program (14)

Post-therapy whole body iodine 131 scans with a gamma camera are typically used after therapeutic doses of ¹³¹I to visualize metastases and guide further treatment decisions.(15-17)

Most studies and guidelines recommend whole body iodine scanning during 4-10 days after radio iodine treatment, with no exact preferred time (2, 12).

Up to now, just one retrospective study has evaluated this issue (18), and no prospective study has been performed, yet. Considering the effect of background activity, uptake ratio in

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tumoral lesions and convenience of the patients and time schedule of the department, the optimal time of imaging should be studied.

Methods

20 patients with DTC, who received radio-iodine in our department, were undergone whole body iodine scanning in three time points, at 4, 7 and 9 days after radio-iodine treatment, respectively. All patients/guardians signed a written consent before entering the study. Similar time duration for each whole body iodine scan (WBIS) in every patients was adopted.

The whole body scanning was performed using a dual head gamma camera(e-cam) equipped with high energy collimators using speed of 7cm per mintues. If any focal area of abnormal tracer activity was noticed, a spot view was obtained from the region for 10 minutes .

Each whole body scan was thoroughly evaluated and reported by two separate nuclear medicine physicians, independently.

All patients’ data including stage of disease, time of radio-iodine (RAI) administration, how many times each specific patient has received radio-iodine before, and each whole body scan findings were recorded and the data was analyzed using SPSS 16.5 software. None of our patients had undergone diagnostic whole body iodine scan before RAI administration.

Results

Twenty (seven men, 13 women) patients, age range 11-78 years, with mean age of 40.5 years,

Including 18 patients with PTC and 2 patients with FTC(follicular thyroid carcinoma) were included in the study. 15 patients had undergone total thyroidectomy and 5 patients had near total thyroidectomy.

The amount of administered radio-iodine activity was 100 millicuries (mCi) in 4 patients (20%), 150 mCi in 11 patients (55%) and 200 mCi of radio-iodine in 5 patients (25%).

From the total of twenty patients, 13 patients had received RAI for the first time, 4 patients for the second time and 2 patients for the third time. Only one patient had received RAI for the 5th time.

Findings in the whole body iodine scan performed after 4 days of RAI administration were as follows: 2 patients (10%) had negative WBIS, 6 patients (30%) had only post surgical thyroid remnant (PSTR), 9 patients (45%) had PSTR plus cervical Lymph node involvement (LNI) and 2 patients(10%) had PSTR, LNI and lung metastasis. One patient(5%) had PSTR , LNI, as well as lung and bone metastasis.

Findings in subsequent whole body iodine scans are summarized in table 1.

In the WBISs performed 4 and 7 days after treatment, 11 patients had cervical lymph node involvement , but in the 9 day after RAI, 9 patients had cervical lymphadenopathy in whole body scan .but, according to Cochran test, this finding was not statistically significant (P-value=0.135)

Table2 shows frequency of cervical lymph node involvement in sequential whole body scans. Figure 1 shows sequential whole body iodine scans in one of the patients.

Table 1. Different patterns of WBIS.

findings	frequency/ in day 4 after RAI	frequency/ in day 7 after RAI	frequency/ in day 9 after RAI
Negative WBIS	2	2	
PSTR	6	6	8
PSTR+LNI	9	9	7
PSTR+ LNI +LUNG metastasis	2	2	2
LNI+LUNG+BONE metastasis	1	1	1

WBIS= whole body iodine scan timing.

RAI=radio iodine

PSTR=post surgical thyroid remnant

LNI=lymph node involvement

Table 2. Frequency of cervical lymph node involvement in three sequential whole body iodine scans.

frequency	4 th day	7 th day	9 th day
Cervical lymph node involvement	11	11	9
total	20	20	20

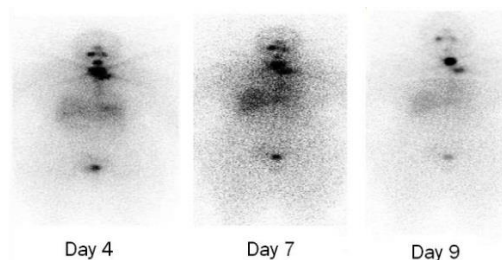


Figure1. Subsequent whole body iodine scanning in one of our patients, showing diminishing cervical activity, by increasing the time from radio-iodine therapy.

Mediastinal lymph node involvement was found in 4 patients (20%). In the WBIS performed 4 days after treatment, which remained the same in the WBIS performed 7 and 9 days after treatment.

Frequency of lung metastasis was also the same in all three sequential whole body iodine scans. 3 patients (15%) had lung metastasis in all three days of scanning.

According to Estimated Marginal Means test, that show the mean response for each factor, adjusted for any other variables in the model, the mean value was 1.74 in the 4th day after RAI administration, while it was 1.66 in the 7th day and 1.6 in the 9th day after RAI administration.

Discussion

RIA is performed with the aim of reducing the risk of mortality and/or recurrence and to facilitate patients' follow-up. Most Differentiated thyroid cancers, have the capacity of iodine trapping and organification, similar to the normal thyroid tissues(19). Sometimes, the possible fact that organification may differ in tumoral cells, comparing with the normal thyroid cells due to the lack or deficits in sodium-Iodide symporter expression, may cause the cells to trap the iodine slowly and with less amount and so the response to treatment may be suboptimal(20).

As was predictable, our study showed that remnant thyroid tissue is the most common finding in three sequential whole body scans. It had prevalence of 45% as the only finding and 85% as accompanied with other findings.

Two patients had negative whole body scans in days 4, 7 and 9 after treatment.

Also, we found no difference in the lung and bone metastasis detection in the whole body scans performed in the days 4, 7 and 9 after RAI administration.

We had no isolated lung or bone metastasis and there were accompanied with PSTR and Lymph node involvement in all metastatic patients.

Mediastinal lymph node involvement was 20% in the WBISs performed 4, 7 and 9 days after RAI, respectively, with no significant change.

Our study showed that cervical lymph node metastasis is more likely to be detected in the 4th and 7th days, compared to the 9 day after treatment. we had 55% cervical lymph node involvement in the first two whole body scans and only 45% in the third one and cervical lymph node involvement was seemed to be missed in 2 of our patients after 9 days. Although it was not statistically significant (P-value=0.135), the Estimated Marginal Mean test showed decline in the iodine uptake in cervical lymph node

metastasis in the last whole body iodine scan. Bor-Tau Hung et al. study also showed that radio iodine uptake and concentration capacity in tumoral cells may decrease over time and delayed images after 1 week have limited value in evaluating the metastatic sites. Also, they stated that whole body imaging in the 7th day after RAI therapy may be of superior diagnostic utility, because there is a balance between background uptake and metastatic sites at that time(18). Our study also showed the same results in the whole body scans performed after 4 and 7 days of treatment, but missing the cervical lymph node metastasis was noticed in the 9th day scan.

Conclusion

we can conclude that according to the radiation safety hazards for staff and technicians of nuclear medicine department and lack of difference in scan findings between 4 and 7 days after RAI, scanning the DTC patients in the day 7 after RAI administration, is more practicable, with less probability of missing the sites of involvement.

Acknowledgements

None.

Conflicts of Interest

There are no conflicts of interest.

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