

Executive Summary

Study on Selection Criteria of Additional Diagnostic Radioiodine (RAI) Whole-body Scan in Differentiated Thyroid Cancer

Seok-Mo Kim¹, Seok-Hyun Kim², Jinseub Hwang², Ji Eun Yoon², Youjin Jung²,
Ji Jeong Park², Ja Seong Bae³, So-Hee Lee³, Hyeung Kyoo Kim¹

¹ Department of Surgery, Thyroid Cancer Center, Gangnam Severance Hospital

² National Evidence-based Healthcare Collaborating Agency

³ Department of Surgery, The Catholic University of Korea Seoul St. Mary's Hospital

□ Background

Domestic rate of thyroid cancer is higher than the OECD average and was top number 1 by taking 19.6% of overall cancers with total 44,007 events in 2012. Based on domestic data, the differentiated thyroid cancer takes majority as 98.7% of overall thyroid cancer.

The treatment of differentiated thyroid cancer in general is done with radioiodine remnant ablation and therapy after surgical management. It includes regular follow-up such as thyroglobulin measurement (serum Tg measurement) and radioiodine (RAI) whole-body scan with thyroid hormone therapy. The RAI whole-body scan is important to follow-up patients with differentiated thyroid cancer and guidelines recommend additional diagnostic whole-body scan to patients with high or intermediate risk. However, it causes increase in medical cost and discomfort in patients due to iodine intake limit.

Importance of additional diagnostic role played by RAI whole-body scan has been decreased as its accuracy in detection of recurrent disease declined; therefore, follow-up with ultrasonography is now paid attention. Also, serum Tg levels are undetectable in most of the patients who had

additional RAI whole-body scan, which eventually requires review on appropriate conduct of RAI whole-body scan.

□ Objective

This study is to find out evidence for selection criteria of additional diagnostic RAI whole-body scan in patients with differentiated thyroid cancer (DTC) who had total thyroidectomy with ¹³¹I remnant ablation and first RAI therapy.

Firstly, domestic trend of patients with thyroid cancer and treatment in recent 5 years (Jul 2009 to Jun 2014) was identified through analysis on the National Health Insurance Claims Data Korea.

Secondly, we found the rate of unnecessary diagnostic RAI whole-body scan and developed a predictive model for selection of additional diagnostic RAI whole-body scan based on the retrospective chart review data.

□ Methods

Review on Guideline

Search of guidelines related to differentiated thyroid cancer was done in 2 foreign and 1 domestic databases. It was searched comprehensively by using the related terms ('differentiated thyroid cancer-', 'guideline-') and we reviewed the full contents.

Analysis on National Health Insurance Claims Data Korea

Analysis of yearly progress and healthcare utilization status of patients with thyroid cancer was conducted in the patients who visited medical facilities from 01 Jul 2009 to 30 Jun 2014 and were found to have thyroid cancer under principal diagnosis or secondary diagnosis (top 5) more than once.

Development of Predictive Model base on Retrospective Chart Review Data

The retrospective chart review data was established and the predictive

model based on it was developed in order to select patients requiring no diagnostic RAI whole-body scan. At that time, 'Patients requiring additional diagnostic RAI whole-body scan' was defined as patients with rs-Tg > 2 or recurrent disease confirmed at the end of follow-up. The established retrospective chart review data was classified by hospital and utilized as a training-set for development of predictive model as well as a test-set for validation of the developed model.

□ Results

- Through analysis of National Health Insurance Claims Data, 32,617 patients were confirmed to have RAI whole-body therapy as year of 2013 and the half of patients who had thyroidectomy were being on whole-body scan more than twice.
- As a result of univariate logistic regression based on the retrospective chart review data, the age, carcinoma size, number of central metastasis, number of lateral metastasis, T stage, first RAI dose and pre-operative Tg, post-operative (short term) Tg and pre- and post-first RAI therapy Tg levels were finally selected as the predictive factors required for prediction of patients in need of additional diagnostic RAI scan.
- Discriminating ability (c-statistics) of the predictive model which was developed on the basis of the selected predictive factors was 0.910.

I. Review on Guideline

As a review result of 560 literatures searched by using foreign databases and other literatures by domestic databases, total 12 literatures were confirmed as the relevant literature. Recommendations by the Korean, American, British Thyroid Associations and National Comprehensive Cancer Network (NCCN) were reviewed mainly focusing on the latest guidelines issued by major academic associations and institutions. Most of

recommendations indicate additional diagnostic whole-body scan might be valid in patients with higher or intermediate risk who had partial thyroidectomy using RAI after total thyroidectomy.

II. Analysis on National Health Insurance Claims Data Korea

As a result of analysis on National Health Insurance Claims Data in recent 5 years to find out patients with thyroid cancer diagnosis, the number of patients with thyroid cancer consistently has increased since 2010, similar to the domestic data previously presented. The number of patients with thyroid cancer diagnosis was total 304,181 as year of 2013; among them, females per gender and 50s per age took majority as 83.5% and 33.1% respectively and then 40s and 60s in order. The number of radical operation of malignant thyroid tumor had increased by 2012, but has not been as high since 2013. It was total 33,841 as year of 2013; among them, females per gender and 50s per age took majority as 80.4% and 30.3% respectively and then 40s and 30s in order.

32,617 patients had RAI whole body scan as year of 2013 and approximately the half of patients who had radical operation of malignant thyroid tumor was found to have whole-body scan more than twice during the same period.

III. Development of Predictive Model base on Retrospective Chart Review Data

Data collection was performed in 1,138 patients (average age 46 years old; female 79.5%) at 2 medical institutions in order to establish selection criteria of diagnostic RAI whole-body scan. It was shown 918 (80.67%) among overall patients had total thyroidectomy + central neck dissection and 216 (18.98%) had total thyroidectomy + Modified Radical Neck Dissection (MRND). The number of patients with recurrent disease at 5 years follow-up was 19 (1.68%).

Through univariate logistic regression, the age, carcinoma size, number of central metastasis, number of lateral metastasis, T stage, first RAI dose and

pre-operative Tg, post-operative (short term) Tg and pre- and post-first RAI therapy Tg levels were finally selected as the predictive factors required for prediction of patients in need of additional diagnostic RAI scan. Discriminating ability (c-statistics) of the predictive model which was developed on the basis of the selected predictive factors was 0.910.

Conclusion and Policy Suggestion

As a result of analysis on National Health Insurance Claim Data in this study, consistent increase in thyroid cancer in recent 5 years and decrease in rate of RAI therapy after thyroid surgery since 2009 were confirmed.

Decrease in rate of patient who had RAI Therapy since 2009 was also confirmed. Although domestic and foreign guidelines recommend additional diagnostic whole-body scan to the patients with high or intermediate risk, now the rate of patient who had whole-body scan more than twice was approximately 50% in context of decrease in number of patients with high or intermediate risk mainly due to early diagnosis.

Analysis on selection criteria of additional whole-body scan conducted in the patients who had total thyroidectomy confirmed < 45 years old, > 1 cm carcinoma size, metastasis to cervical lymph nodes, thyroglobulin right before first RAI therapy, etc. as effecting factors and the predictive model which predicts patients requiring no additional whole-body scan became to be developed based on them. It is expected the predictive model developed in this study enables a number of patients to skip any unnecessary diagnostic RAI whole-body scan. This will help to improve social and economic benefit as well as patients' quality of life.

Acknowledgement

This Research was supported by National Evidence-based Healthcare Collaborating Agency (NECA) funded by the Ministry of Health and welfare (grant number NC15-001).

Key words

differentiated thyroid cancer (DTC), additional Diagnostic radioiodine (RAI) whole-body scan, predictive model