The best results for remnant ablation is achieved with 50 mCi of ^{131}I in almost 90% of patients with papillary thyroid cancer

Kusacic Kuna S, Samardzic T, Tesic V, Medvedec M, Kuna K, Bracic I, Despot M, Dodig D. Thyroid remnant ablation in patients with papillary cancer: a comparison of low, moderate, and high activities of radioiodine. Nucl Med Commun 2009;30:263-9.

SUMMARY

BACKGROUND Patients with papillary thyroid cancer larger than 1 cm ordinarily undergo total thyroidectomy and are usually treated with ^{131}I to destroy the normal thyroid remnant and occult locoregional lymph-node metastases. The amount of ^{131}I given postoperatively is generally selected empirically and arbitrarily, with patients being treated with ^{131}I in amounts ranging from 30 to 100 mCi (1110 to 3700 MBq) to ablate the thyroid remnant, 150 mCi (5550 MBq) to treat patients with macroscopic lymph-node metastases, and 200 mCi (7400 MBq) for lung metastases. There are relatively few studies that compare the efficacy of different activities of ^{131}I for remnant ablation. This is a retrospective study aimed at identifying the smallest amount of ^{131}I that is required to obtain a reasonably high success rate for remnant ablation in patients with papillary thyroid cancer.

METHODS The study cohort comprised consecutive patients with papillary thyroid cancer treated in the Department of Nuclear Medicine and Radiation Protection at Clinical Hospital Centre in Zagreb, Croatia. All the patients were initially treated with total or near-total thyroidectomy and 24 to 120 mCi of ^{131}I (888 to 4440 MBq) after thyroid-hormone withdrawal, without a preceding diagnostic whole-body scan. Scintigraphic imaging was performed in all patients 72 hours after treatment with ^{131}I. Therapeutic outcome was first evaluated with whole-body scintigraphy 6 to 9 months after initial ^{131}I therapy and again 1 year thereafter, using 1 to 5 mCi (37 to 185 MBq) of ^{131}I in patients prepared with thyroid-hormone withdrawal; the second evaluation was performed 12 months later.

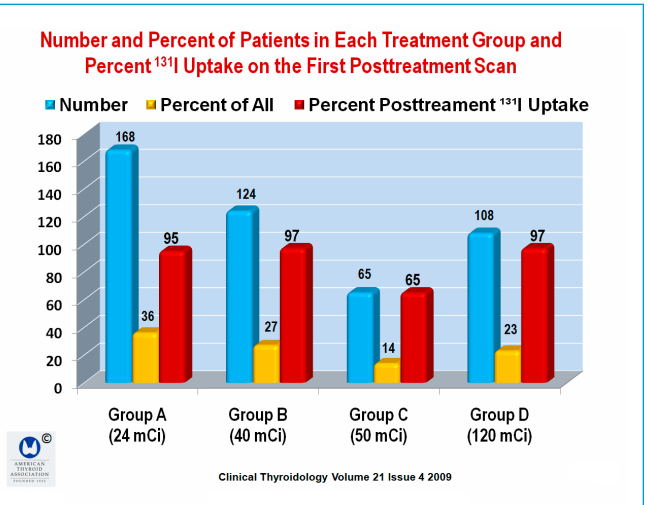

Figure 1. The four treatment groups (A through D) were treated with 24, 40, 50 and 120 mCi, respectively. Uptake of ^{131}I on the initial posttreatment whole-body scan was elevated in all four groups, ranging from 95% to 97%.

Initially, it was usual practice to administer 120 mCi of ^{131}I for remnant ablation; however, over a period of several years, the nuclear medicine physicians began using progressively smaller amounts of ^{131}I for this purpose. To compare the therapeutic efficacy of different amounts of ^{131}I, patients were retrospectively

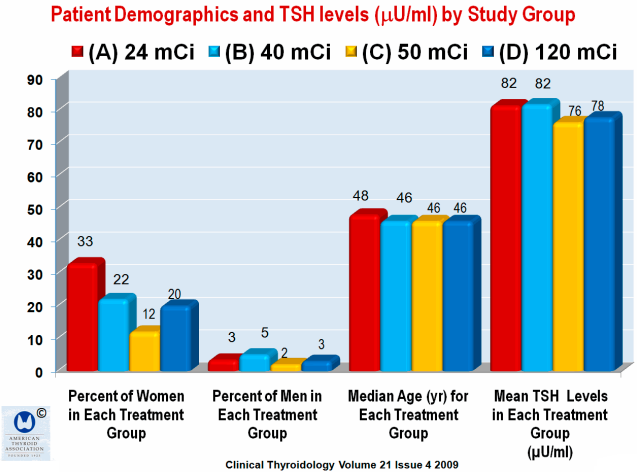

Figure 2. Patient demographics, including sex, median age at the time of diagnosis, and mean serum TSH levels were not significantly different among the four treatment groups.

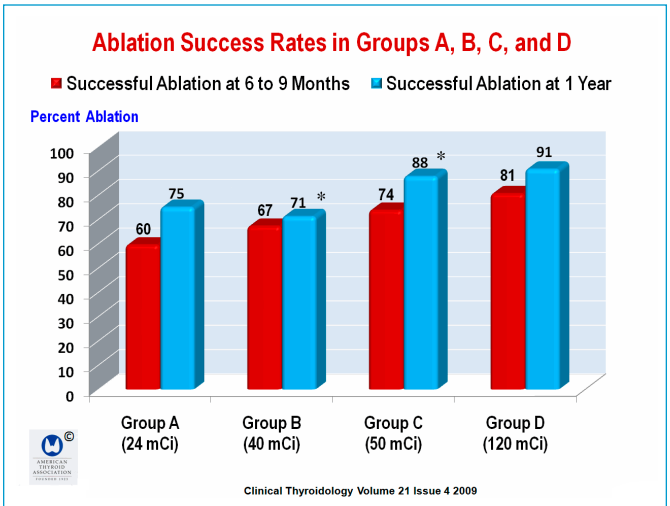

Figure 3. The remnant ablation success rate as determined by a 4-mCi diagnostic whole-body ^{131}I scan at 6 and 9 months of follow-up in groups B (40 mCi) and C (50 mCi) were not statistically significant; however, at the 1-year follow-up, ablation rates were significantly lower in group B than in group C. *P = 0.002. There were no significant differences in the rates of remnant ablation in groups C and D in the 6-year and 9-month follow-ups.

divided into four treatment groups according to the amount of ^{131}I that had been administered: 24 mCi (group A), 40 mCi (group B), 50 mCi (group C), and 120 mCi (group D) (Figure 1).

RESULTS In all, 466 patients comprised the study group—404 (87%) women and 62 (13%) men; the median age of the entire group was 47 years (range, 14 to 78). There were 168 (36%) patients in group A, 125 (27%) in group B, 65 (14%) in group C, and 108 (23%) in group D (Figure 1). Among the four study groups, there were no significant differences between mean age, sex, and thyrotropin (TSH) levels (mean [±SD] TSH was 81.6±37.6, 81.9±37.2, 76.4±393.9, and 77.9±383 μIU/ml; P = not significant, comparing the four groups A through D, respectively) (Figure 2). The postablative ^{131}I scintigraphic imaging 72 hours after initial treatment showed radionuclide accumulation in the thyroid bed in the majority of patients: 160 in group A (95.2%), 121 in group B (96.8%), 65 in group C (100%), and 105 in Group D (97.2%) (Figure 1). Six to 9 months after ^{131}I ablation, the whole-body scan was free of ^{131}I uptake in the neck region in 60%, 67%, 74%, and 82% in groups A, B, C, and D, respectively; and 1 year after follow-up, successful ablation was found in 75%, 71%, 88%, and 82% (Figure 3).

The difference in successful remnant ablation at 6 and 9 months in groups B (40 mCi) and C (50 mCi) were not statistically significant; however, at 1-year follow-up the rates were significantly lower in group B as compared with group C (71% vs. 88%; P = 0.001) (Figure 3); however, in groups C and D, there was no significant difference in the rates of remnant ablation (74% vs. 80.6%) in the first follow-up, nor were there significant differences in the second follow-up in groups C and D (87.7% vs. 71.2%) (Figure 3).

CONCLUSION Fifty mCi appears to be the optimal amount of ^{131}I to achieve a successful rate (90%) of remnant ablation.

COMMENTARY

The amount of radioiodine required for postoperative remnant ablation has been a matter of controversy for decades. The amounts of ^{131}I are generally selected empirically and arbitrarily. Two systematic reviews (1, 2) found that large amounts of ^{131}I, of approximately 100 mCi, are more efficient for remnant ablation than are lower activities of approximately 30 to 50 mCi, particularly after less than total thyroidectomy. The authors of both systematic reviews concluded that patients with differentiated thyroid cancer should routinely be treated with higher amounts of ^{131}I following total thyroidectomy. However, the authors opined that it is not possible to reliably determine whether 30 mCi achieves results similar to those with 100 mCi and that large randomized trials are needed to resolve the issue to guide clinical practice. Such studies are now available.

In a randomized clinical trial aimed at finding the smallest effective amount of ^{131}I for remnant ablation, Bal et al. (3) stratified 565 patients by 5-mCi (185-MBq) increments of ^{131}I into eight study groups treated with 15 to 50 mCi. Patients receiving at least 25 mCi of ^{131}I had a threefold greater chance of achieving successful remnant ablation than did patients receiving smaller amounts of ^{131}I (60% vs. 81%, P = 0.006). The authors concluded that the therapeutic efficacy of 25 mCi or more ^{131}I was equal to 50 mCi.

Another randomized clinical trial by Mäenpää et al. (4) of 160 adults with papillary or follicular thyroid cancer found, after randomly assigning patients to receive either 30 or 100 mCi of ^{131}I, that there was no conclusive evidence that 100 mCi is more effective for ablation of the thyroid remnant than 30 mCi, and that 100 mCi is associated with more adverse effects. In each of the above-mentioned studies patients were prepared with thyroid-hormone withdrawal.

A study by Barbaro et al. (5) of 16 patients prepared with recombinant human TSH (rhTSH) and treated with 30 mCi of ^{131}I found that remnant ablation was achieved in 81% of patients pretreated with rhTSH and 75% treated with thyroid-hormone withdrawal.

A randomized study by Pacini et al. (6) using rhTSH or thyroid-hormone withdrawal in preparation for a 100-mCi treatment of remnant ablation used several criteria for successful ablation: no visible uptake in the thyroid bed, or if visible, radioiodine uptake less than 0.1% on neck scans performed 8 months after therapy. The criteria were satisfied in 100% of the patients in both groups. A secondary criterion for ablation—an rhTSH-stimulated serum thyroglobulin concentration of <2 ng/ml—was fulfilled in 96% of euthyroid (rhTSH) patients and 86% of hypothyroid (withdrawal) patients (P = 0.234). Moreover, euthyroid patients treated with rhTSH received a one-third lower radiation dose to the blood, as compared with the radiation received by patients in the hypothyroid group. This study demonstrates comparable remnant ablation rates in patients prepared for ^{131}I remnant ablation with 100 mCi by either administering rhTSH or withholding thyroid hormone.

Recommendation 36 of the 2009 ATA guidelines (7) for the management of thyroid cancer suggests that the minimum activity (30 to 100 mCi) necessary to achieve successful remnant ablation should be used, particularly for low-risk patients.

The study by Kusacic Kuna et al. shows that 50 mCi provides an optimal result, although the end points for remnant ablation were not as stringent as the studies cited above. Nonetheless, the rate of successful remnant ablation was significantly higher with 50 mCi as compared with 120 mCi, which is especially remarkable considering the high level of ^{131}I uptake on a diagnostic whole-body scan obtained immediately after surgery indicating the presence of large thyroid remnants. Given the major concern about whole-body radiation and second cancers as the result of ^{131}I therapy, it is prudent to follow the ATA guideline suggesting the use of the smallest amount of ^{131}I that is effective. Preparing the patient with rhTSH provides even less whole-body radiation.

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