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Treatment of Hyperthyroidism with Larger Doses of Radioactive Iodine Produces a Higher Success Rate

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SUMMARY

Background

The ideal dose of radioactive iodine-131 (RAI) to cure hyperthyroidism has not been determined, despite more than 60 years of experience with this treatment. Too often patients receive either a dose that causes hypothyroidism within a few months or a dose that produces an insufficient effect, resulting in prolongation of hyperthyroidism. The lack of ability to provide a dose that achieves the euthyroid state has led to acceptance of hypothyroidism as the preferred outcome. The ATA guideline on treatment of hyperthyroidism with RAI states: "Sufficient radiation should be administered in a single dose (typically 10–15 mCi) to render the patient with Graves' disease hypothyroid" (1).

In the current report, the authors compared various doses of ^{131}I with regard to the time required for correcting the hyperthyroidism and the success rate of the various doses used.

Methods

Records were reviewed of all patients with Graves' disease treated with RAI from January 1994 to July 2009 at the Federal University of Parana, Curitiba, Brazil. Successful treatment was defined as hypothyroidism or euthyroidism and being off all antithyroid drugs after a single dose of RAI. Success rates were defined as the number of patients who achieved the successful result after the RAI dose. Antithyroid drugs were not given after the RAI treatment. The doses were divided into groups I (<15 mCi), II (16 to 20 mCi), and III (>21 mCi).

Results

A total of 258 patients were treated with RAI and followed adequately; 85.6% were women, and the mean age was 38.6 years. Mean RAI uptake was 53%. RAI was given after previous treatment with antithyroid drugs in 81% of patients either because of treatment failure (70%) or disease recurrence (11%), or as first-line treatment in 16%, or because of failed surgery in about 2%. The dose was empiric in 85%, calculated in 12%, or based on unknown factors in 2%. The mean (±SD) dose was 21.4± 6.5mCi, with a range between 6 and 29.9 mCi. There were 61 patients in group I, 95 in group II, and 97 in group III. The percentage of patients in each of the three groups in whom hypothyroidism or euthyroidism developed after the RAI dose was 73.7% in group I, 84.9% in group II, and 89.0% in group III (P = 0.045). The average time to successful treatment was 8.1, 4.6, and 2.9 months, respectively.

Conclusions

This study provides evidence that success after RAI therapy for Graves' disease correlates with the dose administered and that successful treatment is achieved earlier with higher doses.

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ANALYSIS AND COMMENTARY

This study is a strong argument for more is better, but does not consider any downside to the large dose of ^{131}I. The ATA is much more conservative: doses of 10 to 15 mCi are the arbitrary doses; or calculated doses are 0.15 mCi/g of estimated thyroid weight corrected for the 24-hour thyroid uptake (1). In my experience, calculated doses are often <10 mCi. In the current study, there was no estimate of thyroid size as a basis for the dose. A study of ^{131}I therapy of hyperthyroidism in Berlin in 1995 pointed out that the success rate of a fixed dose of 15 mCi overall was 71% and was inversely related to thyroid size (2); the calculated radiation dose to the thyroid for a success rate of 85%, similar to group II, was 250 Gy (25,000 rad), a dose seldom achieved by radiation therapy of nonthyroid cancers. Are there consequences of this high-dose therapy other than hypothyroidism?

Franklyn et al. reported a slight increase in small bowel cancer and thyroid cancer in 7500 patients treated with RAI for hyperthyroidism (3). A Finnish study of 2793 patients found slightly increased mortality from cancer of the stomach, kidney and breast compared with a control group (4). However, a recent review of carcinogenicity after RAI for benign thyroid disease concluded that "the absolute risk of developing cancer after ^{131}I therapy for benign thyroid diseases seems low or negligible" (5). Nevertheless, radiation-induced neoplasia is proportional to radiation dose; in this respect, less is better.

The authors treated mainly a lower socioeconomic group in a public hospital outpatient department. They ignored the need for lifelong therapy with levothyroxine as a side effect, as does the current ATA recommendation stated above. I suspect that people in a lower socioeconomic group are more likely to run out of medicine and suffer the consequences of hypothyroidism than a middle-class patient with more access to care.

— Jerome M. Hershman, MD

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