

Optimal Dose of I-131 for Therapy of Thyroid Carcinoma

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Worldwide, the standard treatment of biopsy-proven thyroid carcinoma is thyroidectomy (or partial thyroidectomy) followed by I-131 ablation therapy. Patients are then placed on replacement thyroxine and imaged at 6-month intervals for any remaining active thyroid tissue. Despite the great success of this course of therapy, the optimal dose required varies from one research paper to another. Long-term disease-free survival and recurrence rates show variable statistics. This paper summarizes the latest opinions from experienced specialists in both the USA and other countries.

Thyroid cancer is the most frequent endocrine cancer, and there are reports that the incidence is slowly increasing. In the USA, there are 56,000 new cases of thyroid carcinoma each year.^[1] Following the World War II, the first radioisotope made available for clinical use was I-131.^[2] Endocrinologists and nuclear medicine specialists quickly used this inexpensive isotope to ablate remnants of thyroid carcinoma following definitive thyroidectomy for carcinoma.^[3]

I-131 oral therapy has been the mainstay for the treatment of remnant tissue for 70 years. More than 95% survival rate at 10 years is associated with “differentiated thyroid cancer” (papillary and follicular histologic subtypes).^[4] Other thyroid tumors require alternative therapies: Hurthle cell, poorly differentiated, and medullary thyroid carcinoma. Initial I-131 dosage can be as low as 30 mCi as an outpatient and up to 200 mCi (in the USA).

A trend toward lower dose therapy is now seen in numerous clinical studies. In those countries where outpatient therapy is limited to 30 mCi, radioiodine treatment is unchanged. In the U.S.A., radioiodine (radioactive iodine [RAI]) therapy is frequently 75–100 mCi and is given on an outpatient basis.

Side effects of sialadenitis and nausea can be managed medically. Choice of the proper dose of I-131 (RAI therapy) has remained controversial worldwide. Newer studies point to factors that might prompt adjustment of RAI dosage.

Regardless of country, meticulous thyroidectomy is first performed by experienced surgeons. This is to preserve the parathyroid glands and the recurrent laryngeal nerves. Patients are then placed on thyroxine replacement.

At 6-month post-surgery, the patient is scheduled for the assessment of any remnant thyroid tissue. Thyroxine is withheld until a high level (50–75 units) TSH is achieved. A low dose of 2 mCi of I-131 is used to scan for remnants. The low dose is chosen to prevent presumed thyroid “stunning.”^[5,6]

The United States Regulatory Commission revised Title 10 of the Code of Federal Regulations (10CFR 35.75) in 1997, allowing the release of patients immediately after high-dose RAI therapy with proper instructions to keep radiation exposure to other individuals as low as reasonably achievable.

If there is significant thyroid remnant tissue or locally positive lymph nodes, an ablation dose is given and the patient then discharged. Strict written instructions are given to patient and family members to keep the patient semi-isolated. This avoids unnecessary irradiation of family members.

Repeat whole-body scanning is then initiated at 48 h to confirm satisfactory localization of the I-131. Thyroxine is reinitiated, and serum thyroglobulin has proven the most useful serum tumor marker for ablation and cure.^[7,8]

In countries that limit outpatient therapy to 30 mCi of I-131, repeat dosages can be given if thyroglobulin indicates tumor

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recurrence or if ablation is incomplete.^[9] In the USA, the following guidelines are used: For residual functioning tissue in the thyroid bed: 75–100 mCi, for cervical lymph nodes metastases: 100 = 150 mCi, and for lung or skeletal metastases: 200 mCi.^[10] These recommendations have not changed in over 30 years.

There is a suspicion that occasional differential papillary carcinomas can eventually become far more malignant anaplastic tumor. Similarly, there is literature that now questions if minimal residual remnant tissue visualized on a whole-body scan may eventually resolve spontaneously.

After 30 mCi, such low dose therapy has proven satisfactory. 15% of these patients require a second treatment.^[9] In those countries where single high dose RAI is permitted on an outpatient basis, 75–100 mCi appears now to be the accepted norm.^[10]

For tumors with extensive lymph node spread or multiorgan metastases, an even higher first dose therapy of 200 mCi is needed.^[11] While induced leukemia and other tumors have been reported, the potential mortality of anaplastic thyroid carcinoma must be weighed against the benefits of repeat high-dose therapy.^[12]

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