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Clinical and Laboratory Studies

Outcome of Fixed and Uncalculated Dose of Radioiodine in the Treatment of Hyper Functioning Thyroid Nodules

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Abstract. **Introduction:** This is a prospective study of patients treated for a solitary toxic nodule with a fixed dose of radioiodine (^{131}I) and followed for at least 1 year in Mashhad, north east of Iran. **Methods**: We evaluated 780 patients who presented to the university hospital of Ghaem during a 7-year period because they had at least one thyroid nodule. We found hot thyroid nodules in 95 (12%) patients. Of these patients, 86 (90.5%) were female and 9 (9.5%) were male. Sixty-nine (72.6%) of the patients had thyrotoxicosis and 26 (27.4%) were euthyroid. We treated 49 thyrotoxic patients with ^{131}I and followed them for a minimum of 12 months. The ^{131}I dose for all patients was 15 mCi. The patients underwent thyroid function testing before treatment, at 6 months after treatment, and, thereafter, once every year. **Results**: The single fix dose (15 mCi) of radioiodine was sufficient to control hyperthyroidism in most patients (46/49, 93.8%) in 6 months. Because of persistent hyperthyroidism 6 months after the first dose, 3 patients (6.2%) required a second dose. **Conclusion**: A cure rate of 93.8% can occur within 6 months with a fixed and uncalculated dose of radioiodine. This result is similar to the results of treatment with calculated dose of radioiodine.

Keywords Hot thyroid nodule • Radioiodine • Thyrotoxicosis

Introduction

Thyroid tissue nodularity is common. In the large Framingham, MA study, clinically apparent thyroid nodules were present in 6.4% of women and 1.5% of men.[1] The use of ultrasonography showed that 20% to 76% of women had at least one thyroid nodule.[2,3]

Fifteen percent of thyroid nodules are hot. Hot nodules are caused by hyperplasia of thyroid follicular cells whose functional capacity is independent of regulation by TSH. Activation of somatic mutations of the TSH-receptor gene or Gs-alpha protein[4,5] have been found in toxic adenoma; but mutations of the TSH-receptor gene are the most common cause.[6-10]

Radioiodine (^{131}I) is widely and successfully used for therapy of patients with toxic adenomas.[11] The aim of this study was two-fold: (1) to evaluate the incidence of and acquire demographic data on patients with hot thyroid nodules in Mashhad, north east of Iran; (2) to determine the outcome for patients treated with a fixed dose of radioiodine therapy.

Materials and Methods

During 7 years (May 2002 to April 2009), 780 patients with thyroid nodules presented to the university hospital of Ghaem and were evaluated. Hot thyroid nodules were found in 95 (12%) of the patients.

The diagnosis of a hot nodule was based two factors: (1) the patient had a palpable thyroid nodule corresponding to an area of increased radioiodine concentration on 99mTc-pertechnetate scintigraphy, and (2) suppressed radioiodine uptake in surrounding and contralateral parts of the gland. The diagnosis of hyperthyroidism was based on the clinical picture and

thyroid function testing. Overt hyperthyroidism is defined as a suppressed TSH with high thyroid hormones levels; subclinical hyperthyroidism is defined as a suppressed TSH with normal thyroid hormone levels.

The 49 thyrotoxic patients treated with ^{131}I were followed for a minimum of 12 months. The ^{131}I dose for all patients was 15 mCi. Thyroid function tests were performed before ^{131}I treatment, 6 months after treatment, and, thereafter, once every year.

Statistical Evaluation: Quantitative data were presented as mean ± SD. For statistical evaluation, the Mann-Whitney test and chi-square were used. The level of significance was chosen as $P < 0.05$.

Results

Studies were conducted of 780 patients who had thyroid nodules. Of the 95 patients (12.2%) who had hot thyroid nodules, the mean age was 44.8 ± 15.35. Of these 95 patients, 86 (90.5%) were female and 9 (9.5%) were male. Sixty-nine (72.6%) of patients had thyrotoxicosis (clinical or subclinical) and 26 (27.4%) were euthyroid (Table 1).

Table 1. Characteristic of patients.

Age (years)		44.8 ± 15.35
Sex	Males	86 (90.5%)
	Females	9 (9.5%)
Thyroid status	Hyperthyroid	69 (72.6%)
	Euthyroid	26 (27.4%)
Nodule size (cm)	< 4	44
	≥ 4	51

The mean size of hot nodules was 4.1 centimeters in its largest diameter. Hyperthyroidism at the time of diagnosis was positively correlated with the size of the nodule ($P < 0.01$).

Radioiodine was given as a single uncalculated dose in 49 patients This single fixed dose (15 mCi) of radioiodine was sufficient to control hyperthyroidism in most of patients (46/49, 93.8%) in 6 months. Due to persistent hyperthyroidism 6 months after the first dose, 3 patients (6.2%) required a second dose. Nobody became hypothyroid during follow-up periods.

No significant differences were seen in the initial thyroid nodule size or thyroid function test results between patients who needed only one ^{131}I treatment and those who need more than one ^{131}I treatment.

Discussion

Toxic adenoma is a common cause of hyperthyroidism. The classic presentation for toxic adenoma is a palpable thyroid nodule. The nodule corresponds to an area of increased radioiodine concentration on thyroid scintigraphy in a hyperthyroid patient.

There are three main ways to treat a toxic adenoma: medical therapy with a thioamides that should continue indefinitely, radioiodine, or surgery.

Radioiodine is widely used for therapy of patients with toxic adenomas and is recognized as a safe and effective treatment.[11] It rapidly concentrates in a toxic nodule and causes destruction of the adenoma. Most patients remain euthyroid after radioiodine therapy because the radioiodine mostly accumulates in the hyperfunctioning nodules.[12] for complete treatment of thyrotoxicosis, 10% to 20% of patients may need a second or subsequent dose of radioiodine.

In a large study of 364 patients with hot nodules treated with calculated dose of radioiodine due to nodule size and RAIU, similar results were obtained. A single ^{131}I administration was sufficient to control overt or subclinical hyperthyroidism in 94% of patients.[13]

Other studies have included 53, 45, 52, 27, and 62 patients with hot thyroid nodules. Calculated doses of radioiodine was effective in 75% (14), 93 % (15), 98% (16), 93% (17), and 86% (18) of cases.

In the present study, we analyzed the outcome of 49 patients with hyperfunctioning thyroid nodules treated with 15 mCi ^{131}I at our university hospital during 7 years. We show the effectiveness of an uncalculated fixed dose of radioiodine to treat subclinical or overt hyperthyroidism in 93.8% of our patients. Only 3 patients (6.2%) required a second dose for complete cure of their thyrotoxicosis. Thyroid status and the nodule size did not correlate with the outcome of ^{131}I therapy, as observed by others.[19,20]

Conclusion

Radioiodine is an effective treatment of thyroid hot nodules even with a fixed and uncalculated dose. A cure rate of 93.8% can occur within 6 months. This result is similar to the results of treatment with calculated doses of radioiodine.

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