

Case report

Outpatient administration of radioactive iodine after total thyroidectomy for pediatric thyroid cancer: A report of three cases

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ABSTRACT

Radioactive iodine is used as an anti-cancer reagent for papillary and follicular thyroid carcinomas. Patients that are administered a large dose of radioactive iodine are required to stay alone in an isolated room for several days. Some young children with thyroid carcinoma who cannot take care of themselves are not able to undergo this therapy. We tried outpatient administration of ¹³¹I for these patients. In Japan, administration for outpatients is restricted to 500 MBq (13.5 mCi). We administered 13 mCi ¹³¹I to three patients suffering from pediatric thyroid carcinomas. One patient with recurrent follicular carcinoma in the neck showed complete loss of the thyroid bed and an undetectable level of serum thyroglobulin 7 months after the first administration of ¹³¹I, and no further recurrence was observed after 5 years. Another patient with multiple lung metastases showed weakened uptake of ¹³¹I in the lung and an evident decrease in serum thyroglobulin after administration. However, the last patient with lung metastases with a low ¹³¹I uptake showed no evident change in either ¹³¹I uptake in the lung nor the serum thyroglobulin level. Administration of 13 mCi ¹³¹I was effective in two of three patients. Thus, it is worth considering this therapy as a practical option for pediatric thyroid carcinoma in the countries in which outpatient administration of a large dose of ¹³¹I is restricted.

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1. Introduction

Radioactive iodine is used as an anti-cancer reagent for papillary and follicular thyroid carcinomas [1,2]. In Japan, usually, 30–50 mCi ¹³¹I is used for ablation of the thyroid bed, and 100–150 mCi ¹³¹I is administered for the successive therapy for distant metastases. However, in order to avoid exposing the general public to radiation, the upper limit of ¹³¹I administration for outpatients is restricted to 500 MBq (13.5 mCi). Thus, patients that have been administered a large dose of radioactive iodine are required to stay alone in an isolated room for several days. However, the isolation of young children in this way is usually quite difficult. Thus, patients suffering from pediatric thyroid cancer often cannot undergo this therapy until they are old enough to be able to take care of themselves.

Three patients with pediatric thyroid cancer visited our hospital after they had been refused by several hospitals for ¹³¹I therapy in an isolation room because they were too young. We decided to try outpatient administration of a smaller dose (13 mCi) of ¹³¹I to these patients. This treatment was shown to be effective in two of three patients.

2. Materials and methods

2.1. Laboratory tests

Thyrotropin (TSH) was measured with an electrochemiluminescent immunoassay (ECLusys 2010, Roche Diagnostic, Tokyo, Japan). Free thyroxine (FT4) and free triiodothyronine (FT3) were measured with an enzyme immunoassay (AIA-1800, Tosoh, Tokyo, Japan). Thyroglobulin (Tg) was measured with a radioimmunoassay (Thyroglobulin IRMA Pasteur, Daiichi Radioisotope Laboratories, Tokyo, Japan). Anti-Tg autoantibody was measured with a radioimmunoassay (TgAb Cosmic II, Cosmic, Tokyo, Japan). Anti-Tg autoantibody was absent in all three patients.

2.2. Outpatient ¹³¹I therapy

The therapy was performed after obtaining the parents' informed consent. Levothyroxine was replaced with 25 µg of tri-iodothyronine 4 weeks before the ¹³¹I administration. Tri-iodothyronine was stopped after 2 weeks, and a low-iodine diet was started. Four weeks after levothyroxine withdrawal, 13 mCi ¹³¹I was administered after blood tests. Then, after 72 h, a whole body scan (WBS) was obtained. Immediately after WBS, the low-iodine diet was stopped and levothyroxine was started. ¹³¹I

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Table 1

Laboratory results for Patient 1.

Date	TSH (μ IU/mL)	FT4 (ng/dL)	FT3 (pg/mL)	Tg (ng/mL)	Levothyroxine (μ g/day)
April 2004 ^a	165.11	<0.2	0.7	14.5	0
November 2004 ^a	173.80	<0.2	0.7	<5.0	0

TSH: thyrotropin; FT4: free thyroxine; FT3: free tri-iodothyronine. Normal values: TSH: 0.4–3.8 μ IU/mL; FT4: 0.9–1.6 ng/dL; FT3: 2.0–3.4 pg/mL; Tg: 0–45 ng/mL.^a ¹³¹I was administrated.**Table 2**

Laboratory results for Patient 2.

Date	TSH (μ IU/mL)	FT4 (ng/dL)	FT3 (pg/mL)	Tg (ng/mL)	Levothyroxine (μ g/day)
October 2006	83.50	1.1	3.4	4146.3	50
December 2006 ^a	486.09	<0.2	0.7	8060.0	0
June 2007	200.9	0.6	2.3	2529.6	50
July 2007 ^a	387.14	<0.2	0.8	3267.6	0
December 2007	101.27	0.8	2.7	743.4	75
February 2008 ^a	387.33	<0.2	<0.7	1300.2	0
April 2008	0.22	1.7	4.3	125.4	100
July 2008 ^a	301.80	<0.2	<0.7	908.6	0
February 2009	0.14	1.5	3.1	55.2	100

TSH: thyrotropin; FT4: free thyroxine; FT3: free tri-iodothyronine. Normal values: TSH: 0.4–3.8 μ IU/mL; FT4: 0.9–1.6 ng/dL; FT3: 2.0–3.4 pg/mL; Tg: 0–45 ng/mL.^a ¹³¹I was administrated.

administration was performed at the beginning of the school holidays. The patients were asked to stay at home after ¹³¹I administration. The parents and other family members were asked to avoid unnecessary exposure to radiation due to contact with the patients, especially when they took care of bathing and evacuation.

3. Case reports

3.1. Patient 1

In March 2004, a 6-year-old female was referred to our hospital. Her height and weight were 115 cm and 19.9 kg, respectively. In 2000, she was operated on for a pleuropulmonary blastoma in the lung, and then chemotherapy and bone marrow transplantation were performed. In 2003, she developed a swelling in the right cervical region. Neck ultrasound and computed tomography (CT) scans revealed multiple nodules in the right thyroid lobe. To achieve euthyroidism and to avoid surgical complications, a right hemithyroidectomy was performed rather than a total thyroidectomy. The histological diagnosis was widely invasive follicular carcinoma. Five months later, the tumor recurred in the left thyroid lobe and cervical lymph nodes; therefore, the remaining thyroid lobe was completely excised, and a bilateral radical neck dissection

was performed. More detailed information was given in a previous report [3].

13 mCi ¹³¹I was administrated in April and November 2004. A WBS 72 h after the first administration showed a strong signal in the thyroid bed, and serum thyroglobulin was present. But after 7 months, a second WBS showed complete loss of the thyroid bed and serum thyroglobulin was absent. She was followed with neck ultrasound, lung CT and serum thyroglobulin once or twice a year. No sign of further recurrence has been observed after 5 years (Fig. 1 and Table 1).

3.2. Patient 2

An 8-year-old male underwent total thyroidectomy for papillary carcinoma in 2006. He was referred to our hospital as multiple lung metastases were suspected after a CT. His height and

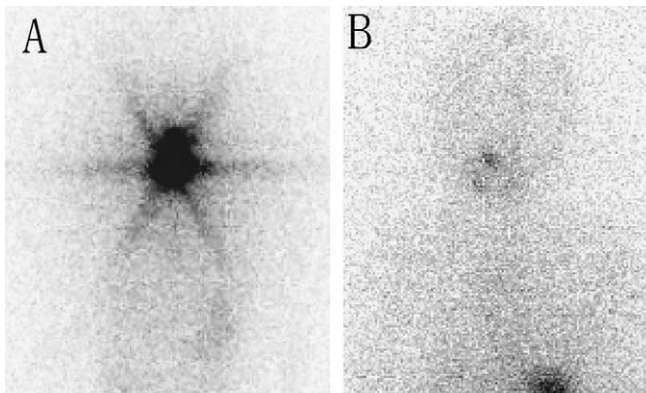


Fig. 1. WBS of Patient 1. (A) After the first administration and (B) after the second administration.

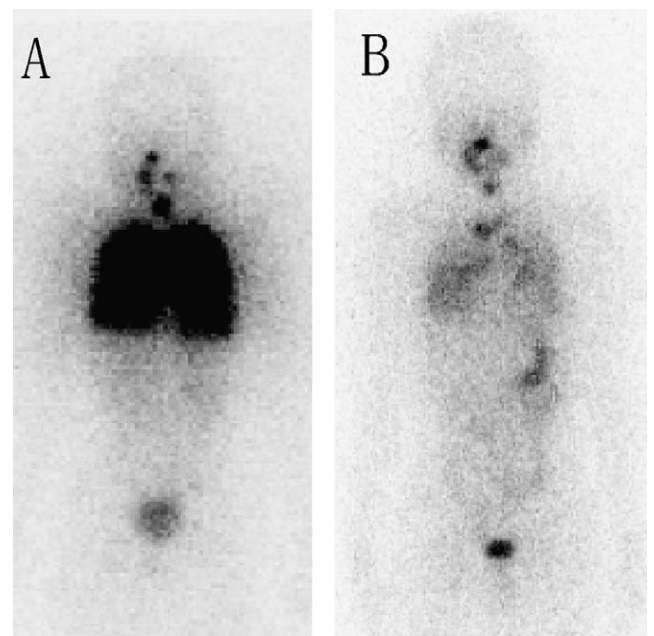


Fig. 2. WBS of Patient 2. (A) After the first administration and (B) after the fourth administration.

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