Trial of Thyroid Autotransplantation in Patients with Graves’ Disease Whose Remnant Thyroid has Unintentionally been Made too Small at Subtotal Thyroidectomy

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Abstract

Autotransplantation of thyroid tissue was carried out in 5 patients with Graves’ disease in order to prevent postoperative hypothyroidism, because the amount of remnant thyroid tissue was estimated to be too small, i.e. from 3 to 5 g. Approximately 0.5 to 2 g of thyroid tissue was cut into small pieces and transplanted into the sternocleidomastoid muscles or the strap muscles. Although the postoperative serum TSH levels were normal or slightly elevated, the serum concentrations of triiodothyronine were within the normal range in these 5 patients at a follow-up study carried out 2 to 7 years after surgery. Thyroid scanning with I-123 or 99mTc-pertechnetate (Tc-99m) revealed radioisotope uptake at the sites of transplantation in 4 of the 5 patients. These findings verify that the implanted thyroid tissues were alive and functioning and that autotransplantation may be a way of preventing postoperative hypothyroidism in patients whose remnant thyroid tissue has unintentionally become too small.

Although autotransplantation of the parathyroid gland has been widely accepted as an useful procedure to prevent the development of hypoparathyroidism at total thyroidectomy for thyroid cancers, successful clinical trial of thyroid autotransplantation has rarely been reported in the literature.

The primary aim of surgical treatment for Graves’ disease is to cure hyperthyroidism, and therefore postoperative hypothyroidism is not necessarily regarded as a complication in most institutions in western countries. In Japan, on the other hand, most surgeons have aimed at a euthyroid state after surgery in patients with Graves’ disease. The reported incidence of hypothyroidism following surgery varies from 5.8 to 7.1% in Japan (Noguchi et al. 1981; Harada et al., 1984) whereas it is from 23.5 to 87% in foreign countries. As the incidence appears to be related to the size of the remnant thyroid tissue left at surgery (Reeve, 1987; Melliere et al., 1988), we may prevent the occurrence of postoperative hypothyroidism...
by autotransplanting thyroid tissue in some patients in whom the amount of remnant thyroid tissue is too small.

We performed thyroid autotransplantation in 5 patients with Graves' disease because the remnant thyroid had unintentionally been made too small at subtotal thyroidectomy.

**Materials and Methods**

When we perform subtotal thyroidectomy on patients with Graves' disease, we usually leaves approximately 3 g of thyroid tissue on each side of the thyroid lobe without taking account of the total thyroid mass. However, if the patient has a large physique, we try to preserve a larger amount of thyroid tissue. The weight of remnant thyroid tissue is estimated by eye measurement. Among 246 patients with Graves' disease treated by subtotal thyroidectomy during the 5-year period from April, 1981 through March, 1986, autotransplantation of thyroid tissue was carried out in 5 patients since the thyroid had become too small.

In these patients, we cut off a piece of thyroid tissue approximately from 0.5 to 2 g in weight from the resected thyroid specimen and sliced it into small fragments some 1 mm³ in size with a scalpel. Many muscle pockets were made in the bilateral sternocleidomastoid muscles or the strap muscles or both, and the fragments were placed into the pockets with microsurgical instruments. Approximately 10 fragments were put into each pocket and great care was taken not to create a hematoma, which could lead to necrosis of the transplanted fragments, in these pockets. The autotransplantation procedure was time-consuming.

The follow-up procedure consisted of measuring the levels of serum triiodothyronine (T3), thyroxine (T4), TSH and, recently, anti-TSH-receptor antibody (TRAb). To evaluate the activity of the transplanted thyroid tissue, I-123 or Tc-99 m scanning of the neck was performed at 2.2-7 years after surgery. Clinical data for these 5 patients are summarized in Table 1.

**Case Report**

**Case 1.**

A 26-year-old man with a 4-year history of medical treatment for intractable Graves' disease was referred to us for surgical therapy. Subtotal thyroidectomy was performed on March 26, 1986. The weight of resected thyroid tissue was 35 g and that of the remnant was unintentionally as small as 4 g. Because the amount of preserved thyroid tissue was thought to be too small to provide a euthyroid state after surgery, about 1 g of thyroid tissue was transplanted into the sternocleidomastoid muscles. The postoperative course was uneventful. Twenty-eight months later, thyroid function tests revealed slight elevation of the serum TSH level whereas the levels of serum T3 and T4 were in the normal range (Fig. 1).

**Table 1.** Clinical data for the five patients with Graves' disease who underwent subtotal thyroidectomy and thyroid autotransplantation.

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Sex</th>
<th>B.W.</th>
<th>TGHA</th>
<th>MCHA</th>
<th>Weight of the thyroid (g)</th>
<th>Thyroid scan</th>
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<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td>Remnant</td>
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<tr>
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<td>M</td>
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<td>&lt;100</td>
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<td>F</td>
<td>45</td>
<td>&lt;100</td>
<td>&lt;100</td>
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<td>4</td>
</tr>
<tr>
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<td>34</td>
<td>F</td>
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<td>26</td>
<td>M</td>
<td>68</td>
<td>&lt;100</td>
<td>800</td>
<td>90</td>
<td>4</td>
</tr>
</tbody>
</table>

B.W. = Body Weight (kg)
TGHA: Anti-thyroglobulin hemagglutination test
MCHA: Anti-thyroid microsomal hemagglutination test
Fig. 1. Postoperative course of the levels of serum TSH, T3, T4 and TRAb of individual patients. The levels of serum T3 and T4 are expressed as "Index" given by:

\[
\text{Index} = \frac{(\text{data} - \text{m})}{\sigma}
\]

where: 
- \( m \): estimated population mean
- \( \sigma \): estimated population standard deviation

Case 1

Case 2

Case 3

Case 4

Case 5
Case 3 is probably a pyramidal lobe. After surgery showing uptake at the autotransplantation sites (arrowheads). The area indicated by arrows in Case 3 is probably a pyramidal lobe after surgery showing uptake at the autotransplantation sites (arrowheads).
A Tc-99m thyroid scintigram taken at the same time showed uptake of the nucleid at the transplantation sites (Fig. 2).

**Case 2.**
A 39-year-old woman was seen in November, 1982 with Graves' disease, which had been treated medically for 5 years. Judging from the clinical course and the negative suppressibility in a T3-suppression test, the ailment was thought to be invertebrate and surgical treatment was indicated. The operation was performed on March 28, 1983. At first the right lobe of the thyroid was resected leaving about 3 g of tissue in the ordinary way. Then we found a papillary carcinoma measuring 2.5×1.5 cm in the upper pole of the left lobe and all of the left lobe was resected. Approximately 2 g of thyroid tissue was transplanted into the strap muscles after being cut into small pieces. The postoperative course was uneventful. Seventy-two months later, the patient was euthyroid except for slight elevation of the serum TSH level (Fig. 1). There was no sign of recurrence of papillary carcinoma. Thyroid scanning with I-123 was performed in October, 1987 and revealed uptake of nucleid at the transplantation sites (Fig. 2).

**Case 3.**
A 34-year-old woman with Graves' disease had been treated medically for 1½ years. Surgical treatment was indicated because of her large goiter and negative suppressibility in a T3-suppression test. On March 15, 1985, she underwent subtotal thyroidectomy. The weight of the resected thyroid tissue was 70 g and that of the preserved tissue was about 5 g. We estimated the size of the remnant to be too small and transplanted approximately 1 g of tissue into the sternocleidomastoid muscles. The postoperative course was uneventful. Because of her pregnancy, a supplementary dose of levothyroxine was given immediately after the operation and continued for a year. The serum levels of T3 and T4 were in the normal range but that of TSH was slightly elevated in August, 1988 (Fig. 1). A Tc-99m thyroid scintigram taken at the same time showed radioisotope uptake at the transplantation sites (Fig. 2).

**Case 4.**
A 28-year-old woman with Graves' disease was referred to our institution for surgical treatment because she had suffered from adverse effects of antithyroid drugs. Subtotal thyroidectomy was performed on October 8, 1984. The weight of the resected thyroid tissue was 26 g and that of the remnant was presumed to be 4 g. The amount of the preserved thyroid tissue was considered to be too small, and hence about 0.5 g of thyroid tissue was transplanted into the sternocleidomastoid muscles. The postoperative course was uneventful. Twenty-six months later, the serum levels of T3, T4 and TSH were all in the normal range (Fig. 1) and a Tc-99m thyroid scintigram showed radioisotope uptake at the transplantation sites (Fig. 2).

**Case 5.**
A 26-year-old man with Graves' disease accompanied by a large goiter was seen in August 1981. Large doses of an antithyroid drug had been required to control his hyperthyroidism for more than one year. Surgical treatment was chosen instead of further medical treatment. On November 18, 1981, subtotal thyroidectomy was carried out and 90 g of thyroid tissue was removed while 4 g of tissue was left. The remnant was thought to be too small for the patient because he had a large physique with a weight of 68 kg. Approximately 1.5 g of thyroid tissue was transplanted widely into the subcutaneous tissue of the neck. The postoperative course was uneventful. In November 1988, 7 years after the operation, the serum levels of T3, T4 and TSH were
normal (Fig. 1) but an I-123 scintigram around the neck failed to demonstrate any uptake of the nucleid at the transplantation sites (Fig. 2).

Discussion

Experimental transplantation of thyroid tissue in animals has been practiced widely but many of the experiments aimed at proposing a model of immunosuppression or studying the role of immunoglobulins in Graves' disease (Fujimoto et al., 1970; Raafl et al., 1976; Jörtso et al., 1987). There are a few reports about autotransplantation of thyroid tissue in clinical practice in order to preserve thyroid function after surgery, especially in a patient with total thyroidectomy for multiple thyroid nodules and in patients with resection of the lingual thyroid (Fujimoto et al., 1967; Swan et al., 1952; Low and Helmus 1961; Sheverdin et al., 1977; Pushkar et al., 1984). These authors reported survival of the transplanted thyroid tissues but they had to supplement hormones because the function of the grafts was insufficient. There are no descriptions of long-term follow-up of any cases.

Most surgeons in Japan leave some 3 g of thyroid tissue on each side at subtotal thyroidectomy for patients with Graves' disease. But we occasionally find that the amount of remnant thyroid has unintentionally been made too small at the completion of an operation. In some cases we tried thyroid autotransplantation to keep the patients in a euthyroid state after surgery.

We reported here 5 cases of thyroid autotransplantation in patients with Graves' disease. The period of follow-up ranged from 2.2 to 7 years. None of them fell into a state of overt hypothyroidism, but a slight elevation of the TSH level was seen in 3 cases. Although it is difficult to determine exactly if the transplanted thyroid tissue functions effectively in each patient, radioisotope study demonstrated uptake of the nucleid at the sites of transplantation, which findings meant survival of the grafted tissue in 4 of the 5 patients. The reason for the negative result in the scintigraphy of Case 5 may be one or a combination of the following: (1) the grafts could not survive, (2) each piece of graft was too small to be detected on examination, (3) activity of the grafts could not be clearly detected because the dose of I-123 was small and the examination was carried out in a short time.

Autotransplantation of thyroid tissue in patients with Graves' disease whose remnant thyroid is estimated to be too small at subtotal thyroidectomy may be a method to preserve thyroid function. But we should be careful in applying this procedure because recurrence of Graves' disease, which is another major problem in surgical therapy, may develop after autotransplantation. An alternative way may be to cryopreserve autogenous thyroid tissue in the form of minute fragments and to transplant them if obvious postoperative hypothyroidism develops.

Reference

Low, H. B. C. and C. Helmus (1961). Thyroid


