Fate of Human Thyroid Tissue Autotransplants

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Abstract

Purpose. We conducted this study to establish whether human thyroid tissue autografts can survive and function in the absence of their native blood supply in muscle. The benefits of this potential could be incorporated in routine surgery to reduce the incidence of postoperative hypothyroidism.

Methods. Fifteen patients with benign thyroid disorders, seven of whom had Graves’ disease and eight, multinodular goiter (MNG), underwent modified subtotal thyroidectomy and the autotransplantation of thyroid tissue in the sternocleidomastoid muscle. About 3–5 g of thyroid tissue was cut and implanted into the sternocleidomastoid muscle. Postoperative clinical assessment, thyroid function tests, and technetium scans of the neck were done to assess the function of remnant and transplanted thyroid tissue.

Results. The transplanted tissue was functional in six of the eight patients with MNG and four of the seven with Graves’ disease. All the patients with MNG and a functional transplant became euthyroid within 6 months postoperatively. Although the transplanted tissue was functional in four patients with Graves’ disease, only one became euthyroid, while the other three required supplemental hormone therapy for postoperative hypothyroidism.

Conclusions. These findings demonstrate the ability of autotransplanted thyroid tissue to survive, function, and grow in muscle.

Key words Thyroid · Autotransplantation · Multinodular goiter · Graves’ disease · Subtotal thyroidectomy

Introduction

The feasibility and fate of human thyroid autotransplantation has not been investigated extensively; however, the results of the few studies⁴–⁷ carried out in this regard are certainly encouraging. We conducted this study to assess if human thyroid tissue autografts can survive in a new environment, such as muscle, in the absence of their native blood supply, and to study the growth and function of the transplanted tissue. The benefits of this potential can be incorporated into routine surgical practice by autotransplanting thyroid tissue at an easily accessible site, with the objective of reducing the rate of postoperative hypothyroidism.

Materials and Methods

This clinical study was approved by the ethical committee of our hospital and Delhi University.

Patients

Patients who required subtotal thyroidectomy for benign thyroid disorders such as Graves’ disease and nontoxic or toxic multinodular goiter (MNG) were included in this study. Patients with proven or suspected malignancy were excluded. Patients with thyrotoxicosis were given medical treatment to achieve euthyroid status preoperatively. Informed consent in accordance with the Declaration of Helsinki was obtained from all of the patients.

Thyroid Function Tests

Serum T₃ and T₄ were measured by radioimmunoassay (RIA) and thyroid-stimulating hormone (TSH) was measured by immunoradiometric assay (IRMA). The normal ranges of T₃, T₄, and TSH were 70–220 ng/dl,
4.5–13.5 µg/dl, and 0.25–5.0 µU/ml, respectively. Postoperatively, euthyroid status was defined by normal T₃ and T₄ levels.

⁹⁹mTc Pertechnetate Scan

Thyroid scanning was done 20 min after giving 5 mCi technetium pertechnetate intravenously. A minimum of 3000 counts was obtained for each scan. The instrument used for scanning was a stationary pinhole collimated scanner gamma camera.

Procedure

All patients underwent modified subtotal thyroidectomy, as isthmusectomy with total lobectomy on one side and subtotal lobectomy on the opposite side. We ensured that no visible thyroid tissue was left behind on the total lobectomy side, so our postoperative imaging studies could detect the tissue transplanted in the sternocleidomastoid muscle on that side. The weight of the thyroid remnant on the side of the subtotal lobectomy varied from 2 to 3 g in the patients with Graves’ disease. In the patients with MNG, all the macroscopic nodules were excised and the remnant weight depended upon the extent of nodularity in the goiter, the maximum remnant weight being 12 g. The weight of remnant thyroid tissue was estimated by weighing the pieces of thyroid tissue cut from the removed portion of the gland, as close as possible in size and appearance to the remnant by common judgment. The excised gland was washed thoroughly in Ringer’s solution and the fibrous capsule was stripped away. The thyroid tissue to be transplanted was removed from the apparently normal area of the excised gland. The weight of the transplanted thyroid tissue depended on the size of remnant thyroid in the neck and the pathology of the thyroid tissue. Therefore, the total weight of both the remnant and the transplanted tissue varied from 4 to 6 g in the patients with Graves’ disease and up to 15 g in those with MNG. This was in accordance with the recommended weight of residual thyroid tissue in respective benign disorders.

In a few of our patients with MNG, extensive nodularity with cystic degeneration was a limiting factor and less than the required amount of tissue could be extracted for transplantation. The tissue to be transplanted was cut into small pieces, 1.5–2.0 mm thick and 4–6 mm wide. Each of these slices was implanted into a small pocket made by splitting the muscle. Each pocket in the muscle was closed over the transplanted tissue with an absorbable suture to prevent displacement. Patients were followed up at intervals of 6 weeks, 3 months, 6 months, and 9 months postoperatively. Clinical examinations were done to assess thyroid status and complications. Postoperative investigations included thyroid function tests (T₃, T₄, TSH) and thyroid scintigraphy. The presence of activity at the transplant site on thyroid scan indicated a functional transplant and the sequential scans depicted the growth of the transplanted tissue. Although a ¹³¹I scan is a better indicator of thyroid function, it was not used because of the risk of exposure to a high dose of radiation.

Results

Fifteen patients underwent modified subtotal thyroidectomy with thyroid tissue autotransplantation; for Graves’ disease in seven and for MNG in eight. Ten of the fifteen patients had a functioning transplant postoperatively (Table 1). Seven of the ten patients with a functioning transplant had euthyroid status by 6 months postoperatively, but three patients with Graves’ disease remained hypothyroid despite a functional transplant. Of the five patients with a nonfunctional transplant, two with MNG were euthyroid and three with Graves’ disease became hypothyroid (Table 1).

Preoperatively, six of eight patients with MNG were euthyroid and two had secondary thyrotoxicosis. The two patients with secondary thyrotoxicosis (patients 1 and 2 in Table 2) had a functional transplant and were euthyroid by 6 weeks postoperatively (Fig. 1). The subsequent scans also showed a functional transplant and these patients remained euthyroid. Two of the six patients with MNG (patients 5 and 6 in Table 2) were euthyroid by 6 weeks postoperatively despite a nonfunctioning transplant (Fig. 2). The transplant site did not show any activity even on subsequent scans in these patients, whose euthyroid status was possibly maintained by the functioning thyroid remnant. The other four patients with non-toxic MNG (patients 3, 4, 7, and 8 in Table 2) were hypothyroid 6 weeks postoperatively with remarkably high TSH levels and a functional transplant (Fig. 3). On subsequent scans, the activity at the transplant site increased and all four patients were euthyroid by 6 months postoperatively.

The patients with Graves’ disease did not show uniform behavior. The transplanted thyroid tissue was

<table>
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MNG, multinodular goiter; GD, Graves’ disease