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Original Research Article

Thyroid autotransplantation following total thyroidectomy in benign thyroid disorders: a new technique to avoid postoperative hypothyroidism

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ABSTRACT

Background: Although total thyroidectomy has become the operation of choice in treatment of BMNG, it leads to permanent hypothyroidism which lead the patient to take a lifelong exogenous hormone replacement therapy, which involves daily administration of levothyroxine at a dose that must be in close follow-up in terms of thyroid hormone levels. In addition, reaching euthyroid status using hormone replacement therapy can be affected in presence of other medical problems that interfere with absorption of the drug as mal-absorption syndrome. When all these are considered, there is a necessity of a novel method to avoid the occurrence of postoperative hypothyroidism.
Methods: A case series prospective study carried out over 30 patients with benign thyroid disorders for whom total thyroidectomy is indicated to evaluate the capacity of auto-implanted thyroid tissue in achieving an euthyroid state without any need for life-long hormone replacement therapy. Postoperative Assessment consists of repeated thyroid function tests and thyroid scan with complementary SPECT/CT.
Results: significant gradual increase in serum levels of T3 and T4 with corresponding decrease in TSH levels returning to normal levels 6-9 months postoperatively. Thyroid scan with complementary SPECT/CT was done for 15 patients to evaluate the functional capacity of the thyroid implant. Among the 15 patients, 13 patients have functioning thyroid implant (success percent: 6.6%). whereas 2 patients show non functioning thyroid implant (failure percent: 13.3%).
Conclusions: Thyroid Auto-transplantation following total thyroidectomy in benign thyroid disorders is an effective method to prevent postoperative hypothyroidism.

Keywords: Hypothyroidism, Thyroid auto-transplantation, Total thyroidectomy

INTRODUCTION

Total thyroidectomy (TT) is now the mainstay procedure for management of patients with bilateral benign thyroid disorders.[1-5] Many authors have reported that TT is now performed safely, and that low complication rates can be achieved with a meticulous surgical technique.[6,7] Although surgery is a good choice to avoid habitual consumption of medications, but patients still require life-long levothyroxine (L-T4) replacement therapy which has been reported to be associated with coronary heart disorders and dysfunction of lipid metabolism.[8,9] Apparently, postoperative control of hypothyroidism after TT by L-T4 replacement therapy seems easy, but for the patient, a daily dose of L-T4 and regular follow-up visits to the hospital may become somewhat a burden, and may interfere with reaching euthyroid status using replacement therapy due to noncompliance of the

patient.[10] Another problem that may interfere with reaching euthyroid status using replacement therapy is mal-absorption of the medication due to any gastrointestinal disorder.[11]

Objective and aim of the study was auto-transplantation of normal thyroid tissue after TT is to avoid postoperative permanent hypothyroidism. Another advantage of thyroid auto-transplantation is maintaining the auto-regulatory mechanism of thyroxin production inside the body according to its needs.[12] Heterotopic thyroid auto-transplantation was proposed to avoid reoperation at the site of previous neck surgery in cases of recurrent goiters or recurrent hyperthyroidism.

METHODS

A case series prospective study carried out at general surgery department, Assiut university hospital from April 2017 to April 2018 over 30 patients with benign thyroid disorders for whom total thyroidectomy is indicated.

Inclusion criteria

- Adult male or female patients with benign thyroid disease.
- Patients who are fit for anaesthesia (ASA score 1&2).
- Patients who provide a written informed consent.
- Patient who agree to provide short term outcome data and agree to provide contact information.

Exclusion criteria

- Male and female children.
- Patients who are unfit for anesthesia (ASA score more than 2).
- Patients with malignant or recurrent goiter.

All patients were subjected to full clinical assessment in the form of full history and physical examination and routine preoperative laboratory investigations, including full blood count, liver function tests, kidney function tests, thyroid function test (T3, T4 and TSH), serum calcium, ECG and chest X-ray.

Neck ultra-sound and fine needle aspiration cytology were done for all patients. All patients are subjected to pre-operative laryngoscopic examination for evaluation of both vocal cord mobility. Informed consent was taken from all patients. All patients were hospitalized the day before surgery and were kept fasting 8 hours before surgery.

Antibiotic prophylaxis was given with induction of anesthesia as a single intravenous dose in the form of (sulbactam/ampicillin) 1500mg-SEDICO Company. Then another dose after 12 hours.

Operative technique

General endotracheal anesthesia is used for all patients. Total thyroidectomy is done for all patients. After complete excision of the gland, the healthiest looking part of the gland is chosen. The thyroid tissue to be transplanted weighs about 2-5 gm. This part is finely divided using scalpel into about 10-15 fragments. Small pocket is made within sternomastoid muscle inside which these very small fragments are implanted and this pocket is then closed with absorbable sutures to avoid displacement of the implanted fragments and marked with metallic stables. Good hemostasis of thyroid bed is done and insertion of tube drains in a separate stab and the skin is closed with subcuticular sutures using absorbable 3-0 vicryl sutures.

Follow up

Follow up procedure consists of measuring serum levels of T3, T4 and TSH after 1month and then every 3 months to evaluate the functional capacity of the implanted thyroid tissue and measuring serum calcium level at the same occasions. Tc-99m pertechnetate scintigraphy with complementary SPECT- CT is done 6-9 months postoperative to evaluate the functional capacity of the transplanted thyroid tissue.

RESULTS

This study was carried out on 30 patients. The mean age was 36.2 ±9.7 with range of 20-55 years old. Female to male ratio is 3:1. Preoperative clinical diagnosis: 18 patients were diagnosed to have simple nodular goiter, 7 primary toxic goiter and 5 secondary toxic goiter. Postoperative histopathological diagnosis, 16 patients have colloid nodular goiter, 8 patients have toxic nodular goiter, 4 patients have Graves 'disease and 2 patients have Hashimoto thyroiditis. The postoperative follow up of thyroid function at 1, 3, 6, 9 and 12 months revealed that there is statistically significant gradual increase in serum level of T3 and T4 returning to normal levels after 6 months following total thyroidectomy without hormone replacement therapy. There is also statistically significant gradual decease in serum level of TSH returning to normal serum level after 12 months.

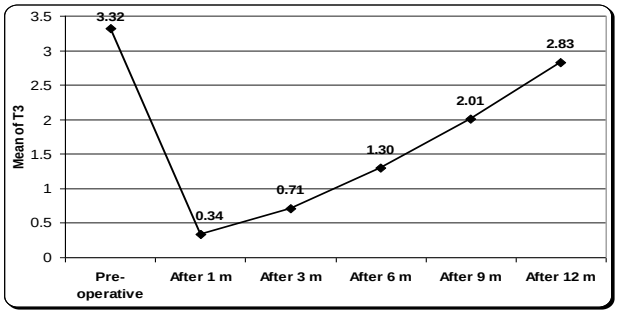

Figure 1: Graph showing pre-and postoperative serum levels of T3.

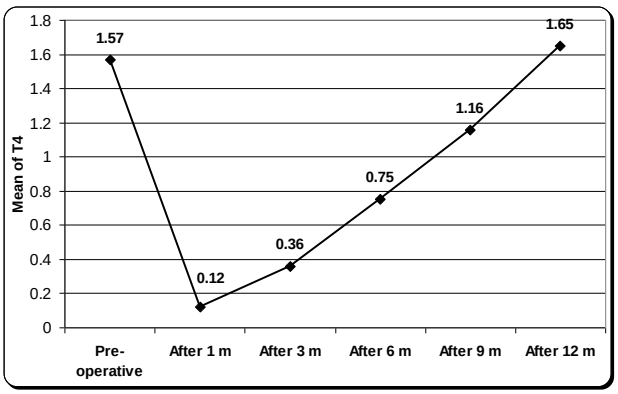

Figure 2: Graph showing pre- and postoperative serum levels of T4.

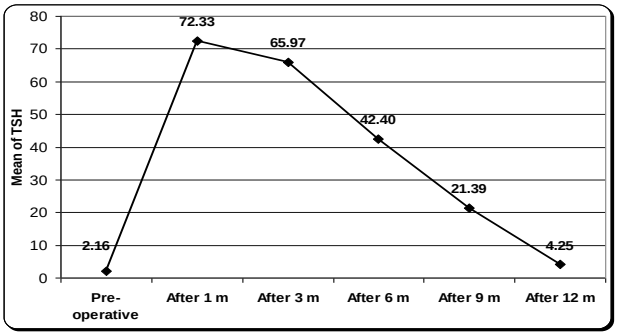

Figure 3: Graph showing pre-and postoperative serum levels of TSH.

99mTC scan with complementary SPECT/ CT was done for 15 patients to evaluate the functional capacity of the thyroid implant.

Among the 15 patients, 13 patients have functioning thyroid implant (success percent:86.6%) 10 of them have functioning thyroid implant at sternomastoid muscle without residual thyroid tissue while the remaining 3 patients have functioning thyroid implant at sternomastoid muscle with faint residual thyroid tissue at thyroid bed. 2 patients show non functioning thyroid implant (failure percent: 13.3%).

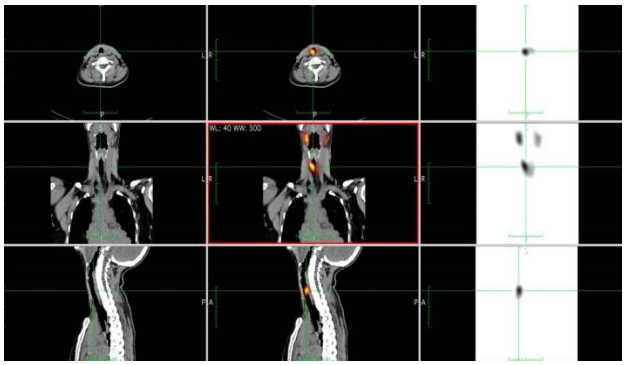

Figure 4: Thyroid scan with SPECT/CT images showing radioactive isotope uptake at the site of thyroid implant (rt. sternomastoid) following total thyroidectomy.

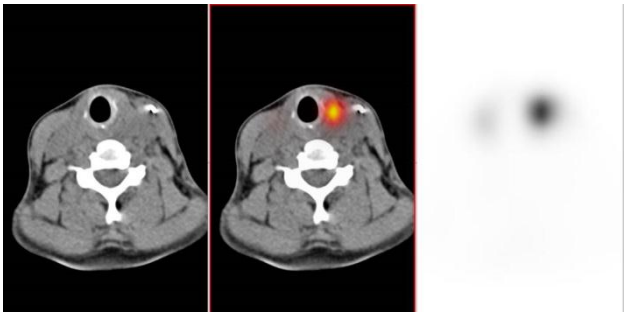

Figure 5: Thyroid scan with SPECT/CT images showing intense uptake of radioactive isotope at left sternomastoid muscle (site of thyroid implant) following total thyroidectomy.

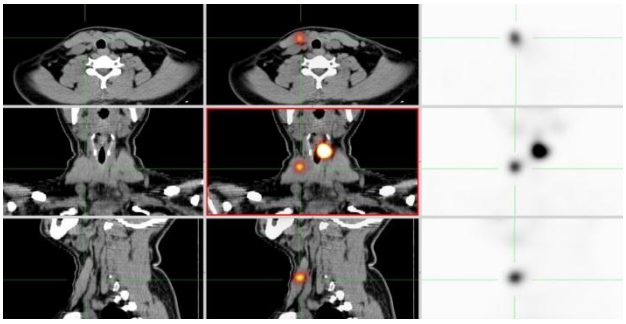

Figure 6: Thyroid scan with SPECT/CT images showing intense uptake of radioactive isotope at the site of implant (rt. Sternomastoid) with residual functioning thyroid tissue.

DISCUSSION

The aim of auto-transplantation of thyroid tissue after total thyroidectomy is the preservation of postoperative thyroid function and the avoidance of substitution therapy with oral intake of thyroid hormones for a lifetime. Another advantage of this method could be the preservation of the inner auto-regulatory mechanism of thyroid hormone production in accord with the needs of the human body. Reports on clinical application of thyroid auto-transplantation are very scarce in the literature, with few patients in each study. Even though all animal and human studies documented the survival and function of thyroid tissue that was implanted in muscle, the technique suffered heterogeneity of tissue preparation (some used frozen, while others used fresh tissue), implant timing, and variability of implant weight.[13-24] This work was set to study the survival and function of thyroid tissues implanted at sternomastoid muscle after total thyroidectomy in benign goiters. In this study, we compared preoperative and postoperative thyroid hormone level and TSH at 1, 3, 6, 9, and 12 months postoperatively. We found marked decline in T3 and T4 serum levels and marked rise in TSH level 1 month postoperative followed by gradual improvement of thyroid function after 3 months. Thyroid function starts to return to normal 6th month postoperatively without hormone replacement. This was found in 20 patients which means that the implanted thyroid tissue is viable

and functioning starting from 3rd month postoperative reaching its full functional capacity after 6 months. 7 patients return to normal thyroid function after 9 months. Whereas 3 patients are found to be hypothyroid after thyroid implantation which means non functioning thyroid implant. Post thyroidectomy speciemen histopathology in these 3 patients revealed that 2 of them have Hashimoto thyroiditis and the 3rd one has primary toxic goiter. These results are compatible with the previous studies concerning thyroid auto-transplantation and the efficacy of thyroid implant in achieving euthyroid state following thyroidectomy without the need for lifelong hormone replacement therapy.[25-30] However, more follow up is needed to evaluate the efficiency of thyroid implant in maintaining this euthyroid state. TC-99m pertechnetate scintigraphy with complementary SPECT-CT is done 6-9 months postoperative to evaluate the functional capacity of thyroid implant. This is the first time SPECT/CT is used to evaluate the viability of thyroid transplant. The uses of SPECT/CT were previously limited to evaluation of thyroid cancer in detection of residual thyroid malignancy and follow up for loco-regional recurrence or distant metastasis. In this study we first use this imaging technique to assess accurately and quantitatively the uptake of radioactive isotope TC-99 m by the implanted thyroid tissue. This thyroid scan was done for 15 patients. We found that among the 15 patients, 13 patients have functioning thyroid implant distributed as following: 10 patients have functioning thyroid implant at sternomastoid muscle without any residual thyroid tissue at thyroid bed. 3 patients have functioning thyroid implant at sternomastoid muscle with faint residual thyroid tissue at thyroid bed. Only 2 patients show non-functioning thyroid implant. Histopathological examination of thyroid speciemen in these two patients proved to be Hashimoto´s thyroiditis.

CONCLUSION

Thyroid Auto-transplantation following total thyroidectomy in benign thyroid disorders is an effective method to prevent postoperative hypothyroidism. However, further studies should be done on larger population scale and over longer duration to assure the validity of this technique.

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