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The impact of age, vitamin D_3 level, and incidental parathyroidectomy on postoperative hypocalcemia after total or near total thyroidectomy

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KEYWORDS:
Hypocalcemia;
Total thyroidectomy;
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Vitamin D

Abstract

BACKGROUND: Hypocalcemia caused by transient or definitive hypoparathyroidism is the most frequent complication after thyroidectomy. We aimed to compare the impact of incidental parathyroidectomy and serum vitamin D_3 level on postoperative hypocalcemia after total thyroidectomy (TT) or near total thyroidectomy (NTT).

PATIENTS: Two hundred consecutive patients with nontoxic multinodular goiter treated by TT and NTT were included prospectively in the present study. Group 1 (n = 49) consisted of patients with a postoperative serum calcium level ≤8 mg/dL, and group 2 (n = 151) had a postoperative serum calcium level greater than 8 mg/dL. Patients were evaluated according to age, preoperative serum 25-hydroxy vitamin D (25-OHD) levels, postoperative serum calcium levels, incidental parathyroidectomy, and the type of thyroidectomy.

RESULTS: Patients in group 1 (n = 49) were hypocalcemic, whereas patients in group 2 (n = 151) were normocalcemic. Preoperative serum 25-OHD levels in group 1 were significantly lower than in group 2 ($P < .001$). The incidence of hypoparathyroidism was significantly higher following TT (13.5%) than following NTT (2.5%) ($P < .05$). The risk for postoperative hypocalcemia was increased 25-fold for patients older than 50 years, 28-fold for patients with a preoperative serum 25-OHD level less than 15 ng/mL, and 71-fold for patients who underwent TT. Incidental parathyroidectomy did not have an impact on postoperative hypocalcemia. The highest risk of postoperative hypocalcemia was found in the patients with all of the above variables.

CONCLUSIONS: Age, preoperative low serum 25-OHD, and TT are significantly associated with postoperative hypocalcemia. Patients with advanced age and low preoperative serum 25-OHD levels should be placed on calcium or vitamin D supplementation after TT to avoid postoperative hypocalcemia and decrease hospital stay.

Total thyroidectomy (TT) is now the preferred option for the management of benign multinodular goiter.[1,2] Postoperative hypocalcemia is the most frequent complication after TT, and it continues to challenge even experienced surgeons since it often extends the duration of hospital stay and increases the need for biochemical tests.[3–6]

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The causes of hypocalcemia after TT are multifactorial, and some of these factors include iatrogenic surgical trauma to the parathyroid glands, incidental parathyroidectomy, the number of functioning glands left behind, extent of surgery, experience of the surgeon, hyperthyroidism, retrosternal goiter, concomitant neck dissection, and thyroid carcinoma.[5–10]

Familiarity with parathyroid anatomy and experience are of crucial importance in thyroid surgery. However, incidental parathyroidectomy may occur even in the hands of the most experienced thyroid surgeon. The incidence of incidental parathyroidectomy ranges from 5%–20%. Incidentally, excised parathyroids are reported in intrathyroid locations in up to 40%–50% of cases.[10–14] In most cases, only 1 parathyroid gland is inadvertently resected with the thyroid. Although some studies suggest that incidental parathyroidectomy does not correlate with postoperative hypocalcemia, its clinical relevance is not yet clear.[10–14]

Vitamin D plays a critical role in calcium homeostasis.[15] After it is acquired by either sunshine or diet, it is converted to 25-hydroxy vitamin D (25-OHD) in the liver. Serum 25-OHD is thought to be biologically inactive. However, it provides the most reliable parameter reflecting the vitamin D status of the body.[15–17] In Turkey, more than 30% of different groups of subjects have vitamin D deficiency.[18,19] Insufficiency in calcium absorption due to low vitamin D concentration leads to an increase in parathyroid hormone (PTH) secretion. Increased PTH stimulates the synthesis of calcitriol and thereby improves calcium absorption efficiency.

The aims of this prospective clinical study are: (1) to compare the impact of age, serum vitamin D_3 level, and incidental parathyroidectomy on postoperative hypocalcemia after TT or near total thyroidectomy, and (2) to determine which risk factors are important for hypocalcemia incidence. To the best of our knowledge, our study is the first prospective study performed to detect the impact of age, preoperative serum 25-OHD level, and incidental parathyroidectomy on postoperative hypocalcemia after TT or NTT.

Materials And Methods

Patients

A total of 200 consecutive patients with nontoxic multinodular goiter treated by bilateral TT and bilateral NTT in the Department of Surgery at the Istanbul Faculty of Medicine between January 2006 and January 2007 were included prospectively in the present study.

The main indications for surgery included large goiter with a compressive effect for all patients. Patients with hyperthyroidism, substernal goiter, previous thyroid or neck operations, or concomitant parathyroid disease, as well as those who refused to participate in this study, were excluded from the present study. None of the patients had signs or symptoms indicating metabolic bone disease, and none of the patients were on medications, such as oral calcium/vitamin D supplementation, anti-resorptive agents, hormone replacement therapy for postmenopausal women, anabolic agents, thiazide type diuretics, or antiepileptic agents, known to affect serum calcium metabolism. The study plan was reviewed and approved by our institutional ethical committee, and informed consent was obtained for all patients.

All thyroid procedures were performed by experienced endocrine surgeons using the conventional clamp-and-tie technique. Vessel sealing systems including ultrasonic dissectors, electrothermal bipolar vessel sealers, and titanium clips were not used. TT was performed by extracapsular dissection. NTT was performed by the capsular dissection method, and less than 1 g of remnant tissue was left around the Berry ligament. For the remnant tissue, we estimated that 1 cm^3 equaled 1 g. Recurrent laryngeal nerves were carefully identified and dissected. All parathyroid glands identified and preserved with meticulous dissection for their blood supply. After resection, the thyroid gland surface was carefully examined for the presence of parathyroid tissue. Parathyroid glands were autotransplanted using a standard technique. Pathology reports were reviewed specifically for the presence, location (ie, extracapsular or intrathyroid), number, size, and histological characteristics of removed parathyroid glands; the results were recorded.

Serum calcium, 25-OHD, alkaline phosphatase, creatinine, and albumin levels were determined the day before surgery. Serum calcium levels were measured 24 hours postoperatively. The lowest postoperative serum calcium level was determined for all patients. Serum calcium concentration was adjusted for serum albumin.

Two hundred patients were divided into 2 groups according to their postoperative calcium levels. Patients in group 1 ($n = 49$) had postoperative serum calcium levels $\leq$8 mg/dL, whereas patients in group 2 ($n = 151$) had serum calcium levels greater than 8 mg/dL. Hypocalcemia was defined as a serum calcium concentration of $\leq$8 mg/dL. Patients with asymptomatic hypocalcemia showed only laboratory findings, whereas patients with symptomatic hypocalcemia had clinical symptoms in addition to laboratory findings. The presence of clinical symptoms or signs of hypocalcaemia were reported, including facial paresthesia, positive Chvostek's or Trousseau's signs, and muscular spasm. Serum calcium levels for hypocalcemic patients were measured every 12 hours until the serum calcium levels stabilized. All patients developing asymptomatic hypocalcemia were treated with oral calcium (3–6 g/d). Symptomatic hypocalcemia was treated with parenteral calcium and an oral 1,25-dihydroxy vitamin D_3 (calcitriol) supplementation of 1–1.5 μg/d. Those patients with asymptomatic hypocalcemia were discharged on oral calcium, whereas patients with symptomatic hypocalcemia were discharged on oral calcium and/or calcitriol at doses modified relative to serum calcium