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Risk factors of incidental parathyroidectomy after thyroidectomy for benign thyroid disorders

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ABSTRACT

Background: Incidental resection of parathyroid tissue is not uncommon during thyroidectomy and may occur even in the hands of experienced thyroid surgeons. We aimed to investigate the clinical relevance of incidental parathyroidectomy and to determine which risk factors are important for it.

Patients: Four hundred and forty consecutive patients with non-toxic multinodular goitre treated by total and near-total thyroidectomy were included prospectively in the present study. Patients in group 1 ($n = 48$) had inadvertent resection of parathyroid gland, whereas patients in group 2 ($n = 392$) did not have parathyroid glands removed.

Results: There was a positive correlation between the incidental parathyroidectomy and total thyroidectomy ($r_s = 0.519$, $p = 0.0001$), and thyroid pathology ($r_s = 0.338$, $p = 0.0001$) and intrathyroid parathyroid locations. Incidental parathyroidectomy did not have an impact on postoperative hypocalcemia. The risk for incidental parathyroidectomy was increased 13-fold for patients who underwent total thyroidectomy (OR: 13.7; 95% CI: 4.08–46.05), 4-fold for patients with substernal goitre (OR: 4.1; 95% CI: 1.1–14.3).

Conclusions: Total thyroidectomy, thyroid pathology, and intrathyroid parathyroid locations are risk factors for incidental parathyroidectomy. All established risk factors for incidental parathyroidectomy are also risk factors for postoperative hypocalcemia. Incidental parathyroidectomy during thyroid surgery may be a potential complication.

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1. Background

Thyroidectomy is one of the most frequent operations performed for patients with non-toxic multinodular goitre. In the recent years total or near-total thyroidectomy have emerged as a surgical option in the surgical treatment of patients with non-toxic multinodular goitre especially in endemic iodine-deficient regions.^{1,2} Transient hypocalcemia is the most frequent complication after thyroidectomy and continue to challenge even the experienced surgeon. Postoperative hypocalcaemia can be a significant clinical problem, which may delay a patient's discharge and require considerable postoperative care in the immediate postoperative period, adding to the cost of the procedure.^{3–5} The etiologies of postoperative hypocalcaemia include surgical trauma, devascularization or inadvertent excision of the parathyroid glands.

Improvements in surgical technique does not eliminate the risk of incidental parathyroidectomy and incidental parathyroidectomy may occur even in the hands of experienced thyroid surgeons.^{4–6}

2. Aim of the study

Although incidental parathyroidectomy is considered as a minor complication of thyroidectomy, there is no consensus about clinical significance and the risk factors of incidental parathyroidectomy.^{7–10} The aims of this prospective clinical study are: (1) to investigate the clinical relevance of incidental parathyroidectomy and (2) to determine which risk factors are important for incidental parathyroidectomy.

3. Patients and methods

A total of 440 consecutive patients with benign thyroid disorders treated by bilateral total thyroidectomy (TT) and bilateral near-total thyroidectomy (NTT) in the Department of Surgery at the

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Istanbul Faculty of Medicine between January 2006 and January 2008 were included prospectively in the present study.

The main indications for surgery included large multinodular goitre ($n = 350$), Graves' disease ($n = 45$), substernal goitre ($n = 30$), and recurrent goitre ($n = 15$). Patients with thyroid carcinoma, 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 were on medications, such as oral calcium/vitamin D supplementation, antiresorptive 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.

3.1. Operations

All thyroid procedures were performed by experienced endocrine surgeons. Total thyroidectomy was performed by extracapsular dissection. Near-total thyroidectomy was performed by the capsular dissection method, and less than 1 g of remnant tissue was left around the Berry ligament. All parathyroid glands identified and preserved with meticulous dissection for their blood supply. When the parathyroid gland had been devascularized during surgery, parathyroid glands were autotransplanted using a standard technique. After resection, the thyroid gland surface was carefully examined for the presence of parathyroid tissue. Pathology reports were reviewed specifically for the presence, location (extracapsular or intrathyroid), number, size, and histological characteristics of removed parathyroid glands.

Four hundred and forty patients were divided into two groups according to incidental parathyroidectomy. Patients in group 1 ($n = 48$) had inadvertent resection of parathyroid gland, whereas patients in group 2 ($n = 392$) didn't remove parathyroid glands. Hypocalcemia was defined as a serum calcium concentration of < 8 mg/dl. Patients with asymptomatic hypocalcemia showed only laboratory findings, whereas patients with symptomatic hypocalcemia had clinical symptoms in addition to laboratory findings.

3.2. Biochemical analysis

Serum calcium, creatinine, and albumin levels were determined with an auto-analyzer (Cobas Integra 800, Roche Diagnostics, Basel, Switzerland). Normal ranges of biochemical parameters were 8.5–10.5 mg/dl for serum calcium, 0.6–1.5 mg/dl for serum creatinine, 3.5–5 g/dl for serum albumin. Serum calcium, creatinine, and albumin levels were determined the day before surgery. Serum calcium levels were measured 24 h postoperatively. The lowest postoperative serum calcium level was determined for all patients. Serum calcium concentration was adjusted for serum albumin. Hypocalcemia was defined as a serum calcium concentration of < 8 mg/dl.

3.3. Statistics

Data were analyzed using SPSS 11.0 for Windows. Results were expressed as mean \pm SD. Comparisons of data used the Mann Whitney *U* test, chi-squared test, and logistic regression analysis. Results were considered statistically significant when the two tailed *p*-value was less than 0.05.

4. Results

The mean (\pm SD) age for all patients was 44.4 ± 12 years (range 17–72 years). The female/male ratio was 5.2/1 ($n = 168/32$). The mean (\pm SD) for serum albumin, creatinine, and calcium levels were

3.7 ± 0.6 g/dl, 0.8 ± 0.3 mg/dl, and 8.8 ± 0.3 mg/dl, respectively. The postoperative serum calcium level was lower than the preoperative serum calcium level (8.8 ± 0.3 mg/dl vs. 8.2 ± 0.7 mg/dl, $p < 0.001$). Incidental parathyroidectomy was found in 48 patients (10.9%). Parathyroid tissue was found in intrathyroidal (68.8%) and extracapsular (31.3%) locations. The mean size of the incidentally excised parathyroids was 3.7 ± 2.1 mm (range, 2–9 mm). In all patients, the parathyroid tissue was histologically normal.

Total thyroidectomy was performed in 111 patients (25.2%) and near-total thyroidectomy in 329 patients (74.8%). There was no operative mortality. The incidence of transient vocal cord paralysis and hypoparathyroidism were 3.4% (15/440) and 13.8% (61/440), respectively. Persistent vocal cord paralysis and hypoparathyroidism were not encountered in our series.

4.1. Evaluation of patients according to incidental parathyroidectomy

The rate of TT for patients with incidental parathyroidectomy (group 1) was significantly higher than that for patients without incidental parathyroidectomy (group 2) (14/49; 28.5% vs. 2/151; 1.3%, $p < 0.001$). The number of parathyroid glands identified during a thyroidectomy (i.e. more or fewer than two) did not influence the rate of incidental parathyroidectomy ($p > 0.05$).

The rate of Graves' disease, substernal goitre, and recurrent goitre for patients with incidental parathyroidectomy (group 1) was significantly higher than that for patients without incidental parathyroidectomy (group 2) (29.1% vs. 7.9% and 12.5% vs. 2.3% and 25% vs. 4.6%, $p < 0.001$); however, the rate of multinodular goitre for patients with incidental parathyroidectomy was significantly lower than that for patients without incidental parathyroidectomy (33.3% vs. 85.2%, $p < 0.001$) (Fig. 1). There was no significant difference in the resected thyroid volume between groups 1 and 2 (69.4 ± 50 g vs. 67.5 ± 33 , $p > 0.05$). The ratio of intrathyroid parathyroid locations was significantly higher in group 1 than in group 2 (100% vs. 0%, $p < 0.001$). No difference in the ratio of postoperative hypocalcemia was found between groups (18.7% vs. 13.7%, $p > 0.05$).

4.2. Correlations

There was a positive correlation between the incidental parathyroidectomy and total thyroidectomy ($r_s = 0.519$, $p = 0.0001$), and thyroid pathology ($r_s = 0.338$, $p = 0.0001$) and intrathyroid parathyroid locations ($r_s = 0.537$, $p = 0.0001$). We did not find a correlation between the thyroid volume and incidental parathyroidectomy.

4.3. Logistic regression analysis

Patient age, the thyroid volume, thyroid pathology, parathyroid locations, and the type of thyroidectomy were independent variables in the development of incidental parathyroidectomy after thyroidectomy. The risk for incidental parathyroidectomy was increased 13-fold for patients who underwent TT (OR: 13.7; 95% CI: 4.08–46.05), 4-fold for patients with substernal goitre (OR: 4.1; 95% CI: 1.1–14.3).

5. Discussion

We found that there was a positive correlation between the incidental parathyroidectomy and total thyroidectomy, thyroid pathology and intrathyroid parathyroid locations. Incidental parathyroidectomy did not impact postoperative hypocalcemia. However, as compared with the group 1, the rate of hypocalcemia was slightly found to be significantly higher than the group 2.

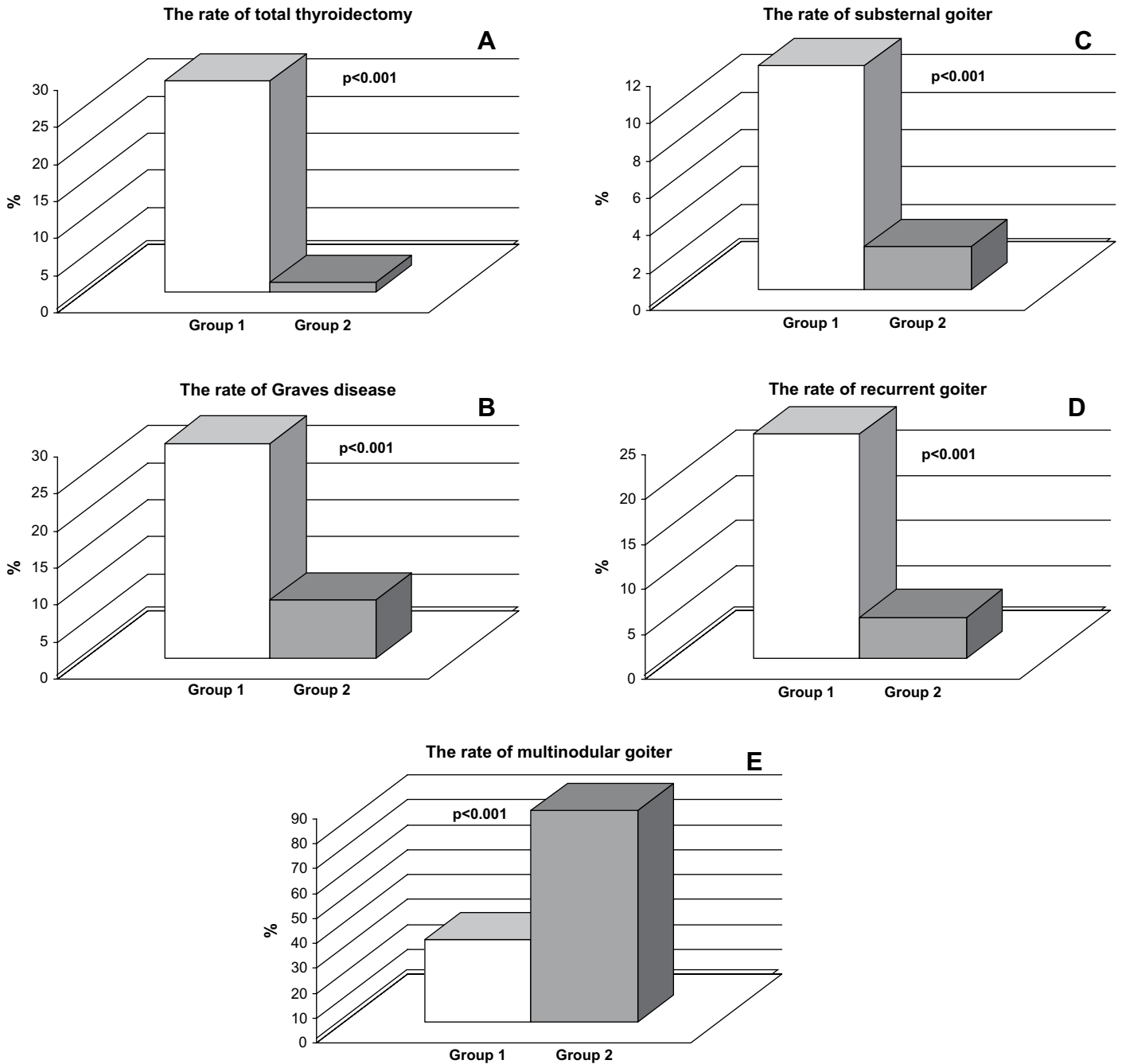


Fig. 1. Evaluation of the groups according to incidental parathyroidectomy. (A). The rate of total thyroidectomy; (B). The rate of Graves disease; (C). The rate of substernal goitre; (D). The rate of recurrent goitre; (E). The rate of multinodular goitre. Group 1: the patients with incidental parathyroidectomy; Group 2: the patients without incidental parathyroidectomy.

According to a logistic regression analysis, the highest risk of incidental parathyroidectomy was found in the patients undergoing TT.

Postoperative hypocalcemia is the most frequent complication after thyroidectomy, and continue to challenge even the experienced surgeon as it often extends the duration of hospital stay and increases the need for biochemical tests. In several studies, the incidence of hypoparathyroidism varied from 1.6% to above 50%.^{3,4,11}

Meticulous identification of the anatomy and preservation of the blood supply to the parathyroid glands is essential. The causes of hypocalcemia are multifactorial and some of the factors involved iatrogenic surgical trauma to parathyroid glands, incidental

parathyroidectomy, the number of functioning glands left behind, extent of surgery, the experience of the surgeon, hyperthyroidism, retrosternal goitre, concomitant neck dissection, and thyroid carcinoma.^{3–6,11–15}

Incidental parathyroidectomy may occur even in the hands of the more experienced thyroid surgeons.^{7,8} The problem of how many parathyroids must be preserved to maintain a normal serum calcium level remains unresolved. Most authors believe that a single functioning gland is enough to restore normal parathyroid activity, whereas others believe that the integrity of at least three glands is necessary.^{7–10} The incidence of incidental parathyroidectomy during thyroid surgery ranges from 8% to 19%.

Almost half of the parathyroid glands are found within the thyroid gland, so incidental parathyroidectomy is unavoidable.^{8,9} In our study, the incidentally resected parathyroid was intrathyroidal in 68.8% of cases.

The clinical significance of incidental parathyroidectomy during thyroid surgery is somewhat obscure. Despite some controversy, it is generally accepted that incidental parathyroidectomy does not cause postoperative hypocalcemia.^{8–10} In our study, no significant correlation was also found between incidental parathyroidectomy and clinical and biochemical hypocalcemia. However, as compared with the group 1, the rate of hypocalcemia was slightly found to be significantly higher than the group 2.

Some authors agree that identifying parathyroid glands during thyroid surgery can result in a lower incidence of incidental parathyroidectomy.^{5,6} However, the ability to identify parathyroid glands during surgery did not have an impact on the rate of incidental parathyroidectomy as our study.

The potential causes of incidental parathyroidectomy include total thyroidectomy, reoperations, and neck dissection.^{3–7} Dissection of the reoperative neck is complicated by scarring, inflammation and bleeding, making accurate identification of the critical structures more difficult. Total thyroidectomy carries potential risk to all parathyroid glands and both recurrent laryngeal nerves.^{3–7}

There is no consensus about clinical significance and the risk factors of incidental parathyroidectomy. However, it must be kept in mind that all established risk factors for incidental parathyroidectomy are also risk factors for postoperative hypocalcemia.

6. Conclusion

Total thyroidectomy, thyroid pathology, and intrathyroid parathyroid locations are risk factors for incidental parathyroidectomy. The risk of incidental parathyroidectomy is related to anatomic factors as same as underlying disease. The highest risk of incidental parathyroidectomy was found in the patients undergoing TT. Incidental parathyroidectomy during thyroid surgery may be a potential complication. We recommend that in patients undergoing TT should be placed on calcium or vitamin D supplementation after total thyroidectomy to avoid hypocalcemia and to decrease the hospital stay.

Conflict of interest

None declared.

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None declared.

Ethical approval

Local ethical committee, Istanbul medical Faculty.

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