

The Effect of Incidental Parathyroidectomy on Hypocalcemia in Patients with Benign and Malignant Thyroid Diseases

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Abstract

Objective: Hypocalcemia is characterized by clinical findings resulting from a decrease in serum calcium (Ca²⁺) and many etiological factors may cause this condition. The most common cause of postoperative hypocalcemia is hypoparathyroidism and the most frequent complication that occurs after thyroid surgery is hypocalcemia. We aimed to investigate the effect of incidental parathyroidectomy on postoperative early hypocalcemia in patients after thyroid surgery.

Methods: Retrospectively analyzed the data of patients who underwent thyroidectomy in General Surgery Department of Abant Izzet Baysal University between January 2009 and December 2018. Age, gender, serum Ca²⁺ and parathormone (PTH) levels were obtained. The histopathological results of thyroidectomy materials were grouped as benign (Group 1) and malignant (Group 2).

Results: The study population was consisted of 3841 patients. 3154 patients were in group 1 and 687 patients were in group 2. The postoperative average serum Ca²⁺ levels of group 1 and 2 were 8.50 mg/dl (6.80-9.80) and 8,50 mg/dl (6.80-9.80), respectively (p=0.996). Postoperative PTH levels of group 1 and 2 were 44.5 ng/l (0-65) and 44.5 ng/l (0-65), respectively (p=0.979). Overall postoperative hypocalcemia (8.4 mg/dL) was observed in 1742 (45.4%) patients. There was no difference in Ca²⁺ and PTH levels between group 1 and group 2. Incidental parathyroidectomy (%5.4) was performed in 209 of total study population who underwent thyroidectomy. 155 (4.9%) and 54 (7.9%) of the patients in groups 1 and 2, respectively and the incidental parathyroidectomy rates of the groups were statistically different (p=0.02).

Conclusion: We think that incidental parathyroidectomy does not stimulate the development of postoperative hypocalcemia.

Key words: Thyroidectomy, Incidental Parathyroidectomy, Hypocalcemia, Hypoparathyroidism

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Introduction

The regulation of plasma calcium levels is important for cell function, neuronal transmission, membrane stability, bone structure, blood coagulation, and intracellular signaling (1). Hypocalcemia is defined as an ionized serum Ca²⁺ concentration that falls below the lower limit of the normal range (8.4-10.2 mg/dL). In normal health, approximately 50% of the total serum Ca²⁺ is in the ionized form in the circulation. The other part of calcium is bound to albumin or complexed with anions such as phosphate (2). Hypocalcemia is characterized by clinical findings resulting from a decrease in serum Ca²⁺ below a certain level (8.0 mg / dL). Many etiological factors may cause this condition in patients. Parathyroid hormone (PTH) is the main regulator of serum Ca²⁺ and phosphate homeostasis (1). PTH deficiency, which also occurs in hypoparathyroidism, causes low calcitriol levels. This prevents the absorption of Ca²⁺ from the intestines (2). The most common cause of postoperative hypocalcemia is hypoparathyroidism. Early hypocalcemia refers to low calcium levels that occur in the first 24 hours postoperatively. This condition is frequently observed after surgical procedures of thyroid and parathyroid glands. The close relationship of the parathyroid glands and the thyroid gland reveals postoperative hypocalcemia in patients with surgical trauma in this region. The most frequent complication that occurs after thyroid surgery is hypocalcemia (3, 4). The rate of temporary hypocalcemia after total thyroidectomy is around 15-30% (5). Six months after surgery, persistent hypocalcemia supports the diagnosis of hypoparathyroidism in the presence of inappropriate or low PTH levels. Hypoparathyroidism is seen in 0.5%-6% after total thyroidectomy (6). This situation occurs when the parathyroid glands are accidentally removed or damaged, or the blood flow of the parathyroid glands is impaired (7). Although hypocalcemia is an expected outcome of parathyroid surgery, it is an undesired consequence of thyroid surgery. In study, we aimed to investigate the effect of incidental parathyroidectomy on postoperative early hypocalcemia in patients after thyroid surgery.

Methods

We retrospectively analyzed the data of patients who underwent thyroidectomy in General Surgery Department of Abant Izzet Baysal University Hospital between January 2009 and December 2018. This study was approved by Haseki Training and Research Hospital ethics committee with permission number 348, dated 02/03/2016. One hundred and

twenty patients, who underwent lobectomy and thyroid surgery with parathyroidectomy for hyperparathyroidism, were excluded from the study. We included the patients only who underwent the total thyroidectomy in our study. Patients' laboratory results and pathology reports was obtained from hospital automation system. Since our study was retrospective, consent could not be obtained from the patients.

Age, gender, serum Ca and parathormone (PTH) levels were obtained. Blood samples were taken 24 hours after thyroidectomy for serum calcium and parathyroid hormone levels. All serum Ca²⁺ and PTH values were measured in the biochemistry laboratory of Abant Izzet Baysal Training and Research Hospital. The normal range of serum Ca level was considered 8.4-10.2 mg/dl, therefore, we grouped patients with a calcium lower than 8.4 mg/dL levels as hypocalcemic. Normal range of PTH was 15-68.3 ng/l and we grouped subjects with a PTH lower than 15 ng/l as hypoparathyroidy. Pathology materials were examined in Abant Izzet Baysal University pathology department. The histopathological results of thyroidectomy materials were grouped as benign (Group 1) and malignant (Group 2). Incidental parathyroidectomies on thyroidectomy materials are determined. The presence or absence of incidental parathyroidectomy in benign and malignant groups and its relationship with hypocalcemia and hypoparathyroidism were investigated.

Statistical analysis

Statistics were carried out by Statistical Package for the Social Sciences (SPSS) software (SPSS 15.0 for Windows, IBM Inc, Chicago, IL, USA). Comparison of the non-homogenously distributed quantitative variables in study groups were done by Mann-Whitney U Test and expressed as median (IQR) and qualitative variables were conducted by Chi-Square test and expressed as n (%). A p value less than 0.05 was considered as statistically significant.

Results

The study population was consisted of 3841 patients. Three thousand one hundred fifty four patients were in group 1 and 687 patients were in group 2. The average ages of both group 1 and 2 were similar 47 years old (p=0.97). Two thousand five hundred thirty eight patients of group 1 were female and 616 patients were male; 551 patients of group 2 were female and 136 patients were male. Gender difference between the groups was not significant (p=0.874). The postoperative average serum Ca

levels of group 1 and 2 were 8.50 mg/dl (6.80-9.80) and 8,50 mg/dl (6.80-9.80), respectively ($p=0.996$). Postoperative hypocalcemia was observed in 1742 (45.4%) patients and 1430 (45.3%) of them were in group 1; 312(45.4%) of them were in group 2 ($p=0.97$). The postoperative hypocalcemia patients serum Ca^{2+} levels of group 1 and 2 were 7.80 mg/dL (6.80-8.30) and 7.80 mg/dL (6.80-7.30), respectively ($p=0.929$). Postoperative hypoparathyroidism was observed in 660 (20.9%) of group 1 and 143 (20.8%) of group 2 ($p=0.94$). Postoperative PTH levels of group 1 and 2 were 44.5 ng/l (0-65) and 44.5 ng/l (0-65), respectively ($p=0.979$).

Incidental parathyroidectomy was performed in 209 (5.4%) of total study population who underwent

thyroidectomy. Incidental parathyroidectomy was performed in 155 (4.9%) and 54 (7.9%) of the patients in groups 1 and 2, respectively. The incidental parathyroidectomy rates of the groups were statistically different ($p=0.02$).

The rate of postoperative hypocalcemia in patients undergoing parathyroidectomy was 45.8% in group 1 and 46.3% in group 2. The difference between the groups was not significantly different ($p=0.95$) (Table 1).

Table 1. Demographical and clinical data of study population

		Group 1	Group 2	p
Gender	Female (n,%)	2538(80.5)	551(80.2)	0.874
	Male (n,%)	616(19.5)	136(19.8)	
Average age (years)		47	47	0.968
Postoperative hypocalcemia (n,%)		1430(45.3)	312(45.4)	0.996
Postoperative hypoparathyroidism (n, %)		660(20.9)	143(20.8)	0.979
Incidental parathyroidectomy	Present (n,%)	155(4.9)	54(7.9)	0.02
	Absent (n,%)	2999(95.1)	633(92.1)	

Discussion

The most striking result of present study is that incidental parathyroidectomy does not associate with postoperative hypocalcemia during thyroidectomy procedures. Nowadays, more systematic approach to thyroid gland diseases has developed. The prevalence of the thyroid diseases is still higher in women compared to men. In our study, we found female to male ratio as 4/1. Bilateral total thyroidectomy is currently the most common procedure in thyroid surgery (8). In our study we included only the patients who underwent total thyroidectomy. In our study, we included patients who underwent only total thyroidectomy, in benign patients because malignant patients underwent total thyroidectomy as a surgical method in our clinic. Thus, we formed homogen groups in which the same surgical method was applied. In order to compare the groups in terms of postoperative hypocalcemia, patients who underwent the same surgical method were selected.

It is a fact that every invasive surgery procedure has a certain complication rate. In thyroid surgery, especially surgery for malignancy, complication rates may increase when total thyroidectomy at a level without remnant thyroid tissue is desired. Among the early complications of thyroid surgery, nerve damage, hypocalcemia and bleeding are the most common (9). It is because of the close anatomical

location of thyroid and parathyroid glands. In most people there are four parathyroid glands. Incidental removal or deterioration of blood supply of these glands during surgery, are the most common causes of hypocalcemia. However, postoperative hypocalcemia has still multifactorial etiology. The rate of incidental parathyroidectomy in thyroid surgery varies between 5-31% (10, 11). We reported this rate as 5.4%. In a prospective clinical study conducted by Erbil et al. it has been reported that hypoparathyroidism rate was 9% in patients who underwent near-total thyroidectomy and was higher in patients undergoing total thyroidectomy with a rate of 26% (12). In our study the rate of early hypoparathyroidism in patients undergoing total thyroidectomy was 20.9%. Our incidental parathyroidectomy rates in thyroid surgery are similar within the literature. Our early hypoparathyroidism rates after total thyroidectomy are slightly lower than the literature.

One of the important factors in incidental parathyroidectomy is aggressive surgery and central neck dissection in malignant thyroid conditions. In our study, 17.9% of patients undergoing thyroidectomy had malignant disease. It was reported that incidental parathyroidectomy rates and hypocalcemia increased in thyroidectomy operations performed according to the principles of oncological

surgery with the diagnosis of cancer (13-15). In present study, incidental parathyroidectomy in malignant group (7.9%) was more common than benign group (4.9%). In our study, after thyroid surgery which performed for malignancy were founded parathyroidectomy rates high and this condition was compatible with literature. However, in our study unlike the literature, there was not difference between the rates of early hypocalcemia on patients who underwent to thyroid surgery for benign group (45.3%) or malign group (45.4%).

In many studies, postoperative hypocalcemia has been reported in 0.3% to 68% of patients undergoing thyroidectomy (16) and the rate of hypocalcemia in early postoperative period is varies between 5.5% and 6.8% (17). Incidental parathyroidectomy on its own, has limited effect on hypocalcemia and hypoparathyroidism. Sasson et al. (18) reported that parathyroidectomy was not associated with hypocalcemia. Accordingly, we found that incidental parathyroidectomy rate was 5.4% in present study, while early hypoparathyroidism rate was 20.9% and early hypocalcemia rate was 45.9%. Our study had similar results therefore, incidental parathyroidectomy on its own does not appear to be associated postoperative hypocalcemia. Postoperative hypocalcemia can occur when the parathyroid glands are damaged or the parathyroid glands the blood flow of was impaired, therefore the necessary sensitivity should be shown during surgery.

The fact that our study is retrospective is the most important limiting factor. This study emphasizes that hypocalcemia that develops after thyroidectomy cannot be attributed to incidental parathyroidectomy alone.

Conclusion

Incidental parathyroidectomy is seen to a certain extent in thyroidectomy surgeries. This condition is seen more in malignant ones than benign ones. But its effect on early hypocalcemia is not relevant. Therefore, we suggest that incidental parathyroidectomy does not stimulate the development of postoperative hypocalcemia.

Ethics Committee Approval: This study was approved by Haseki Training and Research Hospital ethics committee with permission number 348, dated 02/03/2016.

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Author Contributions:

Concept: O.C, **Design:** O.C, M.S; **Literature search:** B.O, **Data Collection and Processing:** B.O, **Analysis or Interpretation:** B.O, **Writing:** O.C, B.O, M.S, S.P.O.

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