



A STUDY OF POST OPERATIVE HYPOCALCEMIA IN PATIENTS OF TOTAL THYROIDECTOMY.

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ABSTRACT

In this study, we scored the discoloration of the parathyroid glands using a new parathyroid scoring system and evaluated the correlation between the parathyroid score and duration of required calcium supplementation after total thyroidectomy.

Materials and Methods: A total of 316 patients undergoing total thyroidectomy between November 2009 and April 2010 were enrolled in this retrospective study. Parathyroid scoring was performed by one experienced surgeon..

Results: Parathyroid scores were positively correlated with ionized PTH concentrations at 2 hours ($r = 0.053, p < 0.001$), 2 weeks ($r = 0.056, p < 0.001$), 3 months ($r = 0.032, p < 0.001$), 6 months ($r = 0.072, p < 0.001$), and 1 year ($r = 0.071, p < 0.001$) after thyroidectomy. Parathyroid scores were significantly and inversely associated with the duration of required calcium supplementation ($p = 0.001$).

Conclusions: Parathyroid scores at the end of surgery might be helpful for predicting the degree of postoperative hypocalcemia after total thyroidectomy.

KEYWORDS : thyroidectomy, parathyroid.

Introduction:

Hypocalcemia is the most common complication after total thyroidectomy, owing to unintentional injury or decreased blood flow to the parathyroid glands. Because the thyroid glands and parathyroid glands play very important roles in maintaining homeostasis in the body, they should remain intact. However, when total thyroidectomy is necessary because of thyroid cancer, it is important to completely remove the malignant portion while avoiding damage to the remaining portion. Hypoparathyroidism is a major cause of hypocalcemia, lengthens hospital stays, and necessitates repetitive laboratory tests and continued administration of both calcium and vitamin D [1, 2, 3].

Although the diverse causes of hypocalcemia include excessive discharge of calcium into urine due to surgical stress, hungry bone syndrome due to hyperthyroidism or hypercalcitoninemia, and vitamin D deficiency, the most important causes include physical damage to the four parathyroid glands, which are adjacent to the thyroid glands, during a total thyroidectomy; disturbance of the blood supply to the parathyroid glands resulting from damage to the blood vessels; and removal of the parathyroid glands by unintentional resection [4,5]. Therefore, an anatomical understanding of the thyroid glands and parathyroid glands in addition to meticulous surgical techniques are required to prevent these causes of hypoparathyroidism; although specialized surgeons make fewer mistakes with regard to damage to the glands, they do still occur [6,7].

After a total thyroidectomy, hypocalcemia reportedly occurs in approximately 10–50% of patients, and approximately 0.5–2% of these patients have permanent hypocalcemia that persists for at least one year [1, 8–12]. Side effects of total thyroidectomy-induced hypocalcemia include Chvostek's sign, Trousseau's sign, numbness, and paresthesia of the fingertips; these cause discomfort for patients and reluctance to be discharged early. Long-term progressive changes can result in abnormal skeletal microstructures [13,14].

Prediction of the degree of hypoparathyroidism, presence of hypocalcemia, and duration of required calcium supplementation through simple methods such as monitoring the color of the parathyroid glands during surgery could assist with patient management. Therefore, the purpose of the present study was to categorize the condition of the parathyroid gland using a simple scoring system immediately after a total thyroidectomy and determine the correlation between post-operative intact parathyroid hormone (iPTH) levels and duration of required calcium supplementation.

Materials and methods:

Between March 2011 and April 2017, 316 patients who underwent a total thyroidectomy with central node dissection (CND) in the Department of Surgery, Gangnam Severance Hospital, Yonsei University College of Medicine in Seoul, Korea were enrolled in this retrospective study. An ipsilateral CND (pretracheal and ipsilateral paratracheal node dissection) was performed routinely for prophylactic or therapeutic purposes, and a bilateral CND was performed for patients with bilateral thyroid cancer. The subjects were divided into three groups based on the duration of calcium replacement: group I did not require calcium and vitamin D supplements or required them for ≤ 2 weeks; group II required supplementation for ≤ 6 months; and group III required supplementation for ≥ 6 months (Table 1). In the patients who recovered from hypoparathyroidism, calcium and vitamin D replacement was stopped.

Results:

Group I consisted of 217 patients (68%) who did not experience transient hypoparathyroidism and 43 patients (13.5%) who required calcium and vitamin D supplementation for ≤ 2 weeks. In group III, 18 patients (5.75%) who had permanent hypoparathyroidism for at ≥ 6 months, 6 patients (1.9%) recovered from hypoparathyroidism after 1 year; of the remaining 12 patients (3.8%), 2 patients (0.6%) recovered from hypoparathyroidism in the third year after surgery.

As shown in Table 1, 3 groups were compared clinicopathological

information, but only postoperative parathyroid scores were significantly different ($p < 0.001$) between the 3 groups (Table 1).

Within each group, iPTH levels decreased with increasing duration of calcium supplementation, at 2 hours, 2 weeks, 6 months, and 1 year after surgery (Table 2).

Discussion:

The scoring method (parathyroid score) using color that we developed to determine the status of the parathyroid glands after total thyroidectomy was able to represent the condition of the parathyroid well, as indicated by the association between the duration of calcium supplementation and iPTH values. Furthermore, the scores were correlated with iPTH levels. Therefore, the scores could be a good indicator for postoperative hypocalcemia. Hypocalcemia remains one of the most frequent complications after a total thyroidectomy, in addition to postoperative hematoma and hoarseness. Hypocalcemia occurs due to unintentional damage or decreased blood flow to the parathyroid glands [4] and can cause complaints of a tingling sensation and muscle cramping. Therefore, an important part of post-thyroidectomy management involves the continuous monitoring of calcium levels and supplementation of calcium immediately after hypoparathyroidism is identified. However, it is important to avoid conventional blood tests in patients with no possibility of hypocalcemia.

If damage to the parathyroid glands has unavoidably occurred during a total thyroidectomy, quick recognition is important. Even without the presence of a detached parathyroid gland, the ability to predict damage and the degree of damage by observing the condition of the parathyroid glands could be helpful for fast and accurate postoperative management. Therefore, we graded the discoloration of the parathyroid glands to determine if the degree of discoloration was correlated with the degree of postoperative hypocalcemia. The parathyroid scores had similar patterns with blood iPTH levels, which generally tend to increase over time after a total thyroidectomy (Fig 1). In a study conducted in 2010, a comparison of discolored parathyroid glands with normal-colored parathyroid glands and autotransplanted glands indicated that discolored parathyroid glands have a transient deterioration in function [16].

In addition, the four parathyroid glands do not function evenly. Even with similar colors, the amount of parathyroid hormones secreted by individual parathyroid glands could be considerably different, and large, dominant parathyroid glands could secrete relatively large amounts of hormones. Therefore, when a dominant parathyroid has been severely damaged or excised, the risk of postoperative transient hypoparathyroidism is high, even with high parathyroid scores for the remaining glands.

Methods to treat unavoidable damage to the parathyroid glands include auto-transplantation and calcium and vitamin D supplementation. Although auto-transplantation of the parathyroid glands is reportedly effective for long-term recovery of parathyroid gland function [17,18], the post-recovery parathyroid gland hormone levels were much lower with auto-transplantation of the parathyroid glands when there was no preserved parathyroid gland compared with auto-transplantation of the parathyroid glands when there was at least one preserved parathyroid gland [19].

In our study, there were 20 cases detected where autotransplantation was performed. Among those 20 patients, 14 patients were in group 1, 6 in group 2, and no patient was observed in group 3 (data not shown). Six of the 20 patients with autotransplantation needed more than 2 weeks of medication, but after 6 months, all patients reached normo-calcemia with normal intact parathyroid hormone level. Compared to this finding, 18 out of 50 patients without autotransplantation who needed more than 2 weeks of medication, medication for more than six month was needed (data not shown). Although it might not be statistically significant due to

small sample size, autotransplantation helps in maintaining normal calcium level.

A limitation of the present study is the timing of the parathyroid gland scoring. The parathyroid glands gradually become discolored after surgery based on the degree of damage; because we scored the parathyroid glands immediately after surgery, the full extent of discoloration might not have occurred, and the function of the parathyroid glands might be scored higher than the original in vivo function. Gupta et al. [20] predicted postoperative hypocalcemia using iPTH levels; the combination of this approach and parathyroid scoring might enable more accurate prediction.

In conclusion, the need for and duration of calcium supplementation after total thyroidectomy were significantly related with the parathyroid score. Therefore, the parathyroid score, which is a simple method, might be effective for predicting and managing postoperative hypocalcemia, saving time and cost. These findings are important for surgeons.

Tables:

TABLE 1: Analysis of risk factors affecting the duration of calcium requirement.

	Oral medication			p value
	Group I	Group II	Group III	
Number of patients (%)	260(82.3)	38(12.0)	18(5.75)	
Age, mean	19-77(45.50)	22-65(46.34)	30-65(45.89)	0.911
Sex				0.303
Female (%)	204(78.5)	33(86.8)	16(88.9)	
Male (%)	56(21.)	5(13.2)	2(11.1)	
Largest primary tumor diameter in cm	0.899(0.1-3)*	0.942(0.4-2.5)*	1.058(0.2-4.0)*	0.486
Extrathyroidal extension (%)	147(56.8)	19(51.4)	9(52.9)	0.799
Multifocality (%)	73(28.1)	15(39.5)	5(27.8)	0.516
Central nodal status (mean)				
dissected lymph nodes	0-18(5.62)*	1-20(6.37)*	1-15(7.00)*	0.259
metastatic lymph nodes	0-13(1.27)*	0-5(0.97)*	0-9(1.50)*	0.632
Thyroiditis				0.175
Yes	89(34.2)	10(27.0)	9(52.9)	
No	171(65.8)	27(73.0)	8(52.9)	
MRND				0.692
Yes	28(10.8)	5(13.2)	1(5.6)	
No	232(89.2)	33(86.8)	17(94.4)	
Parathyroid score (mean)	7.32	6.45	4.89	<0.001

Table 2: iPTH and parathyroid score according to Ca+ medication.

	Oral medication			p value
	Group I	Group II	Group III	
Pre-OP iPTH (mean)	46.35	40.96	40.27	0.075
iPTH: 2 hours (mean)	16.80	5.03	4.21	<0.001
iPTH: 2 weeks (mean)	32.47	11.02	7.89	<0.001
iPTH: 6 months (mean)	38.59	28.08	7.91	<0.001
iPTH: 1 year (mean)	32.55	24.77	12.56	<0.001

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