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## ORIGINAL ARTICLE

# Single measurement of intact parathyroid hormone after thyroidectomy can predict transient and permanent hypoparathyroidism: a prospective study

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**KEYWORDS**

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Thyroidectomy;  
Vitamin D

**Summary Objective:** Immediate postoperative hypocalcemia is the most common complication of bilateral thyroidectomy. Although hypocalcemia is usually transient, it can be fatal. This study aimed to find a predictor of immediate postoperative hypocalcemia by using intact parathyroid hormone (PTH) level at 4 hours after thyroidectomy (iPTH4hr) compared with the decline in the percentage of intact PTH (%iPTH). We also followed the subjects for evaluation of permanent hypoparathyroidism.

**Methods:** This was a prospective study of 65 patients (86.2% female, mean age: 43±15 years) who planned to undergo total or subtotal thyroidectomy. Preoperative and iPTH4hr were measured.

**Results:** Thirty-nine patients (60%) were diagnosed with papillary thyroid carcinoma, while the rest were multinodular goiter (21.5%) and Graves' disease (7.7%). Significant immediate hypocalcemia was observed in 25 (38.5%) patients. Both iPTH4hr <12.5 pg/mL and %iPTH decline >72% could accurately predict significant immediate hypocalcemia. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for iPTH4hr were 92%, 87.5%, 82.1%, and 94.6%, respectively. The %iPTH decline was equal in accuracy, with

Conflicts of interest: None of the authors have any conflict of interest to declare.

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sensitivity, specificity, PPV, and NPV of 84%, 90%, 84%, and 90%, respectively. At 6 months after surgery, 19 patients (29.2%) displayed permanent hypoparathyroidism. The iPTH4hr <12.5 pg/mL and %iPTH decline >72% could also predict permanent hypoparathyroidism, with sensitivity, specificity, PPV, and NPV of 100%, 80.4%, 67.9%, and 100%, and 94.7%, 84.8%, 72%, and 97.5%, respectively.

**Conclusions:** Only a single measurement of iPTH4hr could be helpful in identifying patients at risk of significant immediate hypocalcemia in need prompt treatment, and subsequently facilitating early discharge of patients. Also, this parameter can precisely predict permanent hypoparathyroidism.

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## 1. Introduction

Total thyroidectomy (TTD) is currently the standard surgical procedure for the management of benign and malignant thyroid diseases. Hypocalcemia from postoperative hypoparathyroidism is the most common complication of TTD. The reported incidence varies; most series reported an incidence of transient postoperative hypocalcemia of ~20% to 30%.<sup>1</sup> The symptoms are mostly transient and asymptomatic, ranging from mild paresthesia and tingling to severe complications, e.g., tetany and convulsion. Only 4.4% of patients develop permanent hypoparathyroidism.<sup>2</sup>

Owing to rapid turnover of intact parathyroid hormone (iPTH), with a half life of approximately 2–5 minutes, serum iPTH is an excellent marker of parathyroid function.<sup>3</sup> This is evidenced by the fact that intraoperative iPTH determination is useful for identifying whether a hypersecreting parathyroid adenoma has been removed. However, calcium kinetics are slower. The decrease in iPTH precedes the decline in calcium, which reaches the trough level approximately 24–48 hours after surgery.<sup>3</sup> This might lead to delay in diagnosis and treatment of postoperative hypocalcemia.

Previous studies found many predictors of immediate post-thyroidectomy hypocalcemia: (1) single iPTH or quick PTH measurement<sup>4–9</sup>; (2) percentage of intact PTH (%iPTH) decline from baseline<sup>10–13</sup>; (3) calcium slope<sup>14</sup>; (4) 25-hydroxyvitamin D (25(OH)D) status<sup>15</sup>; (5) underlying thyroid disorders, such as Graves' disease; (5) types of operation and surgical techniques, e.g., central node dissection<sup>16</sup>; and (6) number of identified parathyroid glands.<sup>17</sup> Lombardi and colleagues found that an iPTH level at 4 hours (iPTH4hr) after surgery of <10 pg/mL accurately predicted immediate post-thyroidectomy hypocalcemia, with 94% sensitivity, 100% specificity, and 98% accuracy.<sup>4</sup> They investigated further to verify the reliability of this iPTH4hr cut-off point in a larger series of patients.<sup>18</sup> The results showed that subnormal iPTH4hr levels correlated with hypocalcemia, but did not accurately predict postoperative hypocalcemia, with sensitivity, specificity, and overall accuracy of 84.9%, 77.6%, and 78.6%, respectively. More recently, Lecerf et al.<sup>13</sup> found that iPTH4hr <19.4 pg/mL accurately predicted postoperative hypocalcemia.<sup>13</sup> Additionally, %iPTH decline of >68.5% within 4 hours after surgery accurately predicted immediate post-thyroidectomy hypocalcemia.<sup>13</sup>

However, the accuracy of iPTH measurements is inconsistent,<sup>1,5</sup> and there are large differences in the study designs, PTH assays, timing of sampling, threshold maintenance, and data analysis among all series.

The aims of our study were to assess the risk factors and determine the predictive value of iPTH4hr and the rate of iPTH decline associated with immediate and permanent postoperative hypoparathyroidism.

## 2. Materials and methods

### 2.1. Data collection

This was a prospective study of 65 adult patients who had planned to undergo TTD and subtotal thyroidectomy. Exclusion criteria included history of parathyroid gland diseases, history of neck radiation, history of hypercalcemia or hypocalcemia, pregnancy, or chronic kidney disease from stage 3 and up. The study protocol was approved by the Ethics Committee of Ramathibodi Hospital, and informed consent was obtained from each of the eligible patients.

The information collected from all patients included surgical data and medical records, especially the details of their thyroid diseases, e.g., preoperative diagnosis, thyroid hormone status, thyroid gland weight (reported in grams) by pathological evaluation, type of operation, central lymph-node dissection, operative time, and final path histological report.

Preoperative serum total calcium (mg/dL), albumin (g/dL), 25(OH)D (ng/mL), estimated glomerular filtration rate by Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) formula, and iPTH (pg/mL) were obtained on the day of the operation. Serum total calcium was repeatedly measured daily until its normalization. The 25(OH)D was measured by chemiluminescent immunoassay, and iPTH was subsequently measured at 4 and 24 hours after the end of the operation; an iPTH assay was performed with an automatic analyzer (Cobas e 601; Roche, Basel, Switzerland) using an electrochemiluminescent immunoassay technique. The manufacturer range for serum iPTH levels was between 15 pg/mL and 65 pg/mL. Concerning the optimal timing of iPTH measurement, Lombardi et al.<sup>3,4</sup> and Lecerf et al.<sup>11,13</sup> found great precision with

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