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# A Single Parathyroid Hormone Level Obtained 4 Hours after Total Thyroidectomy Predicts the Need for Postoperative Calcium Supplementation



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- BACKGROUND:** Parathyroid hormone (PTH) levels after total thyroidectomy have been shown to predict the development of symptomatic hypocalcemia and the need for calcium supplementation. This study aimed to determine whether a PTH level drawn 4 hours postoperatively is as effective as a level drawn on postoperative day 1 (POD1) in predicting this need.
- STUDY DESIGN:** This is a single-institution retrospective review of 4-hour and POD1 PTH levels in patients who underwent total thyroidectomy from January 2012 to September 2012. If POD1 PTH was  $\geq 10$  pg/mL, patients did not routinely receive supplementation; if PTH was  $< 10$  pg/mL, patients received oral calcium with or without calcitriol.
- RESULTS:** Of 77 patients, 20 (26%) had a 4-hour PTH  $< 10$  pg/mL; 18 (90%) of these patients had a POD1 PTH  $< 10$  pg/mL. No patient with a 4-hour PTH  $\geq 10$  pg/mL had a POD1 PTH  $< 10$  pg/mL. All 18 patients with POD1 PTH  $< 10$  pg/mL received calcium supplementation. Three additional patients received supplementation due to reported symptoms or surgeon preference. A 4-hour PTH  $\geq 10$  pg/mL compared with a POD1 PTH had a similar ability to predict which patients would not need calcium supplementation; sensitivity was 98% vs 98%, specificity was 90% vs 86%, and negative predictive value was 95% vs 95%. Of 21 patients who received supplementation, 13 (62%) also received calcitriol, including 9 patients (69%) with a 4-hour PTH  $< 6$  pg/mL.
- CONCLUSIONS:** A single PTH level obtained 4 hours after total thyroidectomy that is  $\geq 10$  pg/mL accurately identifies patients who do not need calcium supplementation or additional monitoring of serum calcium levels. Same-day discharge, if deemed safe, can be accomplished with or without calcium supplementation based on the 4-hour PTH level. Greater consideration should be given to calcitriol supplementation in patients with a 4-hour PTH  $< 6$  pg/mL. (J Am Coll Surg 2014;219:757–764. © 2014 by the American College of Surgeons)
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Hypocalcemia due to inadvertent devascularization or removal of parathyroid glands is the most frequent complication after total thyroidectomy, and occurs in 2% to 47% of patients.<sup>1-3</sup> The majority of cases of iatrogenic hypoparathyroidism are transient (defined as  $< 6$  months), but rates of permanent hypoparathyroidism

have been reported to be as high as 14%.<sup>2-7</sup> The optimal approach to identify individuals at risk for clinically significant hypocalcemia after total thyroidectomy remains poorly defined. Various protocols have been published for postoperative patient management, and many patients receive repeated unnecessary laboratory testing. Some authors suggest routine calcium supplementation of all patients with calcium and/or calcitriol and others recommend selective supplementation based on serum calcium and/or parathyroid hormone (PTH) levels.<sup>2,5-21</sup>

Using early postoperative PTH levels as a guide for calcium and vitamin D management is well established.<sup>10,12-15,18,19</sup> The 2007 Australian Endocrine Surgeons guidelines<sup>12</sup> reported that a normal postoperative PTH level drawn 4 hours after total thyroidectomy is highly predictive of normocalcemia. In a recent prospective randomized

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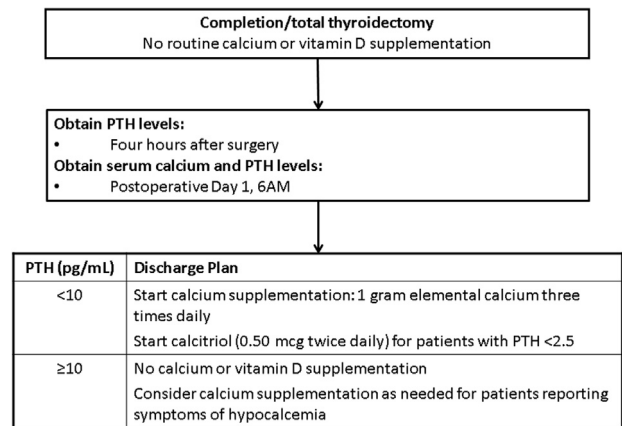
study of patients who underwent completion/total thyroidectomy, we demonstrated that a single PTH level on postoperative day 1 (POD1) was highly specific for predicting those patients at risk for clinically significant hypocalcemia.<sup>18</sup> Only 10% of patients with a POD1 PTH level  $\geq 10$  pg/mL reported transient symptoms suggesting possible hypocalcemia and none of these patients required calcium supplementation at hospital discharge.

Previous studies have not demonstrated a difference between postoperative PTH levels obtained at 4 hours vs 23 hours.<sup>10,14</sup> The hypothesis of this study is that a 4-hour PTH level accurately identifies those patients who do not need calcium and/or vitamin D supplementation (PTH level  $\geq 10$  pg/mL) and, importantly, allows for early identification and supplementation of patients at risk for postoperative hypocalcemia (PTH  $< 10$  pg/mL), which potentially reduces the frequency and severity of hypocalcemic symptoms in this patient subset.

## METHODS

This is a single-institution, retrospective review of all patients who underwent total or completion thyroidectomy by one of three endocrine surgeons between January and September 2012. Patients who underwent simultaneous parathyroidectomy (for hyperparathyroidism) and those younger than 18 years of age were excluded. This study was approved by our institutional IRB.

Before surgery, serum calcium, PTH, and 25-OH vitamin D levels were obtained, and vitamin D supplementation (ergocalciferol 50,000 U weekly) was recommended for patients with a preoperative 25-OH vitamin D  $< 32$  ng/mL. Operative management for patients with differentiated thyroid cancer and for parathyroid autotransplantation at our institution has been described previously.<sup>18</sup> Although we routinely autograft all devascularized parathyroid glands, an autograft would not be expected to function in the early postoperative period. A serum PTH level was obtained at 4 hours after surgery and on the morning of POD1 (Fig. 1). Calcium supplementation (2,500 mg calcium carbonate [1 g elemental calcium], 3 times daily) was initiated for patients with a PTH  $< 10$  pg/mL, either at 4 hours or on POD1; vitamin D supplementation (calcitriol, 0.5  $\mu$ g twice daily) was added for a PTH  $< 2.5$  pg/mL and/or at the attending surgeon's discretion. Asymptomatic patients with a 4-hour PTH  $< 10$  pg/mL and a POD1 PTH  $\geq 10$  pg/mL were not discharged on calcium supplementation. Symptomatic patients were evaluated on a case by case basis; symptomatic hypocalcemia was defined as any patient who reported symptoms of perioral or digital numbness/tingling, or muscle cramps in the upper or lower extremities. Patients were contacted 24 to 72 hours after



**Figure 1.** Algorithm for calcium and vitamin D supplementation after completion/total thyroidectomy. PTH, parathyroid hormone.

discharge and symptoms of hypocalcemia were documented and treated as necessary.

At the first postoperative clinic visit, patients were evaluated for symptoms of hypocalcemia. Patients who were not discharged on supplementation and who remained asymptomatic did not routinely have laboratory tests done. Serum calcium and PTH levels were obtained only for those patients started on calcium supplementation and/or calcitriol supplementation, or if persistent symptoms of hypocalcemia were reported after discharge; laboratory tests were not routinely obtained for patients who were started on ergocalciferol preoperatively. Our institution uses a standard protocol for management of hypocalcemic symptoms and weaning of calcium and calcitriol: patients taking both calcitriol and calcium are first weaned from calcitriol by decreasing the dosage by 0.25  $\mu$ g every 3 days, and once weaned from calcitriol, the dose of calcium carbonate is decreased by 1 g elemental calcium every 3 days. Serum calcium and PTH levels were not routinely obtained after the first postoperative visit.

Data collected included age; sex; preoperative and postoperative calcium, PTH, and 25-OH vitamin D levels; extent of surgery (simultaneous central and/or lateral neck dissection, parathyroid autotransplantation); and final pathology (including benign disease vs cancer and parathyroid tissue removed). Postoperative calcium and calcitriol supplementation and presence of hypocalcemic symptoms when in hospital and after discharge were recorded. The primary outcomes measured included need for routine calcium supplementation based on either 4-hour PTH  $< 10$  pg/mL and/or development of symptomatic hypocalcemia (as defined here). Statistical analysis was performed using STATA IC 12 software (Stata Corp). A p value  $< 0.05$  was considered statistically significant.

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