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## Vitamin D deficiency does not increase the rate of postoperative hypocalcemia after thyroidectomy

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### KEYWORDS:

Thyroidectomy;  
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Central neck  
dissection

**BACKGROUND:** Hypocalcemia is a frequent complication of thyroidectomy. Although typically mild and temporary, it can lead to an increased length of stay, readmission, and in some cases be permanent. Controversy exists as to whether vitamin D deficiency (VDD) contributes to post-thyroidectomy hypocalcemia.

**METHODS:** This is a retrospective study of 152 patients who underwent thyroidectomy. Patients with or without VDD were compared. Data were analyzed for demographics, operative procedure, calcium levels, and complications of hypocalcemia.

**RESULTS:** There was no difference in the rates of biochemical or symptomatic hypocalcemia or in the need for readmission between the VDD and non-VDD groups. A multivariate analysis controlling for central neck dissection, parathyroid autotransplant, and preoperative diagnosis confirmed no association between VDD and post-thyroidectomy hypocalcemia.

**CONCLUSIONS:** Despite VDD being common in patients undergoing thyroidectomy, our results do not suggest that this increases the rate of hypocalcemia. Thus, preoperative evaluation/repletion of VDD is unlikely to reduce post-thyroidectomy hypocalcemia rates.

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Hypocalcemia is the most common complication after thyroidectomy. The reported incidence, depending on how hypocalcemia is defined, varies widely from as low as 1.6% to 50% or more.<sup>1–6</sup> Only a small percentage of patients with biochemical hypocalcemia develop symptoms, which most commonly manifest as mild perioral or distal acral paresthesias. Less frequently, patients may develop more severe

symptoms such as carpopedal spasm; tetany; laryngospasm; or, in rare cases, cardiac arrhythmias.<sup>1,7</sup> Although in most cases it is only temporary, post-thyroidectomy hypocalcemia can lead to an increased cost by prolonging the length of stay and increasing the need for expensive medications, blood tests, outpatient visits, and readmissions.<sup>8–10</sup> Furthermore, hypocalcemia can be a significant source of stress and financial burden to the patient and poses a challenge to even the most experienced thyroid surgeons.

The cause of hypocalcemia after thyroidectomy is due to either temporary or permanent hypoparathyroidism resulting from “stunning,” devascularization, or inadvertent re-

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removal of the parathyroid glands.<sup>1–3,7</sup> Factors that have been reported to influence the risk of hypocalcemia include concomitant central neck dissection (CNDx), a parathyroid autotransplant (PATx), locally advanced malignancy, Graves disease, and surgeon experience/volume.<sup>3,6,9,11–13</sup> However, few studies have identified preoperative factors that would allow targeted therapy aimed at lowering the rate of post-thyroidectomy hypocalcemia.

Vitamin D is a fat-soluble vitamin that plays an important role in calcium homeostasis by increasing gastrointestinal tract absorption of calcium.<sup>14,15</sup> Vitamin D deficiency (25 hydroxy vitamin D <20 ng/mL) is common, with a prevalence in the United States of more than 40%.<sup>15</sup> Thus, it would seem that vitamin D deficiency might be a good candidate for a potentially modifiable factor in the risk of developing hypocalcemia after thyroidectomy. However, few studies have examined the role of vitamin D in postoperative hypocalcemia in patients undergoing thyroidectomy, and the results of those studies have been mixed.<sup>1,2,11</sup> Despite ongoing debate regarding its usefulness and cost-effectiveness, postoperative supplementation with calcium and/or vitamin D is commonly used in patients undergoing thyroidectomy.<sup>13,16</sup> Further study of the role of vitamin D in post-thyroidectomy hypocalcemia may allow a more selective approach. The purpose of this study was to examine whether vitamin D deficiency is associated with an increased risk of hypocalcemia after thyroidectomy.

## Methods

### Patients

Approval for this study was granted by the Colorado Multiple Institutional Review Board (protocol 10-1477). A retrospective analysis was performed of 152 patients undergoing near-total thyroidectomy between 2007 and 2011 for whom a 25-hydroxyvitamin D level was drawn at the preoperative appointment. All surgeries were performed at the University of Colorado Hospital by 1 of 2 experienced endocrine surgeons (RCM or CDR). Patients were excluded if they had undergone previous thyroid or parathyroid surgery, had concomitant hyperparathyroidism, or had dialysis-dependent renal failure.

After surgery, all patients were admitted to the hospital and routinely supplemented with oral calcium carbonate, 500 mg 3 times daily, and vitamin D (cholecalciferol), 2,000 IU daily. Serum calcium levels were monitored every 8 hours, and patients were discharged when it was determined that they had stable calcium levels and no symptoms of hypocalcemia. For patients who developed symptomatic or significant biochemical hypocalcemia, oral calcium carbonate was increased to 1,000 mg 3 times daily; intravenous calcium gluconate was administered; and patients were started on calcitriol, .25  $\mu$ g to .5  $\mu$ g twice daily. Oral calcium supplementation and, when indicated, calcitriol

were continued until their 2-week postoperative appointment; at this point, these medications were either stopped or continued as clinically indicated. All patients were eventually able to discontinue calcitriol.

Data were collected for demographics (ie, sex, age, and body mass index), preoperative factors (ie, fine-needle aspiration cytology, total 25-hydroxyvitamin D, parathyroid hormone, creatinine, and calcium), operative details (ie, concomitant CNDx and/or PATx), and postoperative outcome (ie, lowest inpatient calcium, symptoms of hypocalcemia, the length of stay, the need for intravenous calcium gluconate and/or calcitriol, and the need for readmission). Data were then analyzed for patients with or without vitamin D deficiency using a preoperative vitamin D threshold of either <30 ng/mL or <20 ng/mL.<sup>17</sup>

### Definitions

A near-total thyroidectomy (NTTx) was defined as the removal of all grossly visible thyroid tissue, leaving minimal to no tissue adjacent to the recurrent laryngeal nerve at the ligament of Berry. CNDx was defined as the removal of the level VI lymph nodes with the limits of our dissection being from carotid to carotid artery laterally, the cricoid superiorly, and the brachiocephalic vessels inferiorly. Parathyroid glands were identified and preserved on their vascular pedicle whenever possible. Incidentally removed or devascularized glands were autotransplanted in standard fashion to the sternocleidomastoid muscle.

Vitamin D insufficiency and deficiency were defined as a 25-hydroxyvitamin D level <30 ng/mL or <20 ng/mL, respectively, and were based on the current Endocrine Society consensus guidelines.<sup>17</sup> Biochemical hypocalcemia was defined as a serum calcium <8.0 mg/dL, and patients were deemed to have symptomatic hypocalcemia if this was associated with any complaints of perioral or distal acral paresthesias, carpopedal spasm (3 patients), or tetany (2 patients). Permanent hypoparathyroidism was defined as hypocalcemia requiring calcium replacement and calcitriol beyond 6 months after surgery (no patients).

### Statistics

Data analysis was performed using the statistical software package R version 2.14.2 (available at [www.R-project.org](http://www.R-project.org)). Univariable comparisons were made using 2-sample *t* tests when the response was over a continuum and either the chi-square or Fisher exact test when the response was categorical. The chi-square test was preferentially used over the Fisher exact test when possible. Multivariable linear and logistic regression models were used to look at the association between any of the noted responses and the following possible predictors: vitamin D deficiency, concurrent CNDx, concurrent PATx, the number of parathyroid glands transplanted, and a preoperative diagnosis of cancer or a suspicion for malignancy. Because of overdispersion in the logistic regression models, quasi-likelihoods were used.

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