




# Hypothyroidism following gastric sleeve surgery resolved by ingesting crushed thyroxine tablets

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## ABSTRACT

Bariatric procedures for weight loss have increased in the past few decades. Levothyroxine malabsorption has been reported following gastric bypass; however, few studies have addressed this issue after gastric sleeve procedures. Levothyroxine dosing is usually weight based and administered at approximately 1.6 µg/kg body weight. Absorption occurs mainly in the jejunum and upper ileum, which can be altered by gastric pH, other drugs, food, and other factors. We present a 35-year-old woman with longstanding iatrogenic hypothyroidism treated with thyroxine, whose thyroid-stimulating hormone level rose following a gastric sleeve procedure despite taking levothyroxine daily.

**KEYWORDS** Bariatric surgery; gastric sleeve; hypothyroidism; powdered levothyroxine

Hypothyroidism is a common disorder, with a prevalence rate of 12% in morbidly obese patients.<sup>1</sup> Levothyroxine is the primary treatment for hypothyroidism.<sup>2</sup> It is absorbed in the duodenum and jejunum with a bioavailability of 60% to 80% in healthy patients.<sup>3</sup> However, gastric pH affects this absorption. Patients on proton pump inhibitors and antacids experience significantly reduced bioavailability.<sup>3</sup> Other factors that affect levothyroxine absorption include gastrointestinal diseases<sup>3</sup> and the formulation of thyroxine.<sup>4</sup> Marked changes in thyroid function have been documented following bariatric surgery.<sup>5,6</sup> Though gastric bypass is the gold standard for weight loss management, sleeve gastrectomy has demonstrated efficacy as well.<sup>7</sup> Few reports indicate changes in thyroid function following gastric sleeve surgery. We present a 35-year-old woman with hypothyroidism on thyroxine replacement who developed an elevated thyroid-stimulating hormone (TSH) level secondary to gastric sleeve bypass.

## CASE PRESENTATION

A 35-year-old morbidly obese Hispanic woman with known diabetes mellitus and hypertension underwent a total thyroidectomy for papillary thyroid cancer and received radioactive iodine postoperatively. Two years following thyroidectomy, she underwent a gastric sleeve procedure.

Medications included levothyroxine 200 µg, 10,000 IU vitamin D3, 1800 mg calcium carbonate twice a day, and 0.5 µg calcitriol twice a day. Her body mass index (BMI) was 59.88 kg/m<sup>2</sup>. She was euthyroid on thyroxine replacement.

Two weeks after receiving a gastric sleeve, the patient was asymptomatic and lost 45 lb, with a BMI of 55.72 kg/m<sup>2</sup>. Five months after gastric sleeve, she complained of numbness in the extremities but admitted to intermittent compliance in taking calcium and levothyroxine. Her BMI was 49.75 kg/m<sup>2</sup>. She was educated on medication compliance at this time. Physical exam revealed a positive Chvostek's sign bilaterally. Eight months after gastric sleeve, she showed signs of hypothyroidism and hypocalcemia. She presented with fatigue and joint pain. Laboratory results revealed a TSH of 38.10 mU/L (normal 0.27–4.20 mU/L), T4 of 0.74 µg (normal 0.93 to 1.70 µg), and BMI of 46.23 kg/m<sup>2</sup>. Despite medication adjustment and ensuring compliance, her hypothyroidism did not resolve until levothyroxine was crushed prior to oral intake. TSH values normalized 5 months after giving the instruction to crush levothyroxine.

## DISCUSSION

Recent reports confirm marked changes in levothyroxine absorption after bariatric procedures. However, most prior documentation follows gastric bypass patients rather than

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Received July 2, 2019; Revised September 9, 2019; Accepted September 16, 2019.

**Table 1. Results of patients with hypothyroidism undergoing bariatric procedures**

Procedure type	BMI decrease (kg/m <sup>2</sup> )	TSH change (mU/L)	Levothyroxine		Study
			dosage decrease (µg)	Measurement follow-up (months)	
LSG	10.5	3.9 ↓	29.3	11	Rudnicki et al <sup>9</sup>
LSG	45.8	N/A	35.6	1	Garg et al <sup>7</sup>
LRYGB	12.8	N/A	45.4	1	Garg et al <sup>7</sup>
LRYGB	10.8	4.2 ↓	30	11	Rudnicki et al <sup>9</sup>
LRYGB	5	5.37 ↑	None	3–4	Fallahi et al <sup>8</sup>
BPD	5.5	6.17 ↑	None	3–4	Fallahi et al <sup>8</sup>

BMI indicates body mass index; BPD, biliary pancreatic diversion; LRYGB, laparoscopic Roux-en-Y gastric bypass; LSG, laparoscopic gastric sleeve; TSH, thyroid-stimulating hormone.

gastric sleeve patients. To our knowledge, this is the first case report in which a patient developed iatrogenic hypothyroidism after a gastric sleeve procedure.

The difference between gastric bypass and the gastric sleeve is related to the surgical involvement of the stomach. Gastric bypass surgeries such as the Roux-en-Y procedure act by mostly bypassing the stomach, stapling it, and leaving only a small pouch about the size of an egg intact.<sup>8</sup> The pouch is then connected to the small intestine, where it can still supply its digestive juices without allowing food to travel through the intact stomach.<sup>8</sup> The gastric sleeve also removes a significant portion of the stomach, though less than with gastric bypass. Stomach volume is significantly reduced after bariatric surgery, with fewer parietal cells and subsequently higher pH levels. Ingested material does not pass through the stomach but passes straight through to the small intestine in order to decrease absorption. This has significant implications for levothyroxine absorption (*Table 1*).<sup>1,7–9</sup>

Levothyroxine is a synthetic lipophilic drug administered in tablet form to patients with hypothyroidism. For efficacious absorption, it is ideally taken on an empty stomach with a wait of 4 hours before resuming other medications.<sup>1</sup> Because calcium and iron ingestion have potential adverse effects on thyroxine absorption, our patient received separate scheduling of calcium supplements.<sup>3</sup> We do not believe that proton pump inhibitors caused the decreased levothyroxine absorption.

Formulation of levothyroxine may have an important bearing on absorption. Powdered thyroxine can normalize TSH values.<sup>10</sup> New liquid formulations of thyroxine may have better bioavailability, be less dependent on gastric pH, and be better absorbed with a meal.<sup>3</sup> Normalization of TSH values after switching from tablets to an oral liquid formulation has been documented.<sup>6</sup> Patients after bariatric surgery with subsequently elevated TSH have shown better absorption when using the liquid formation.<sup>8</sup>

Studies reveal decreases in TSH levels in euthyroid patients after a gastric sleeve procedure.<sup>11</sup> Additionally, patients on levothyroxine after gastric sleeve have demonstrated decreased TSH levels.<sup>7</sup> In contrast, our patient presented with elevated TSH after a gastric sleeve procedure, suggesting a patient-to-patient variability in levothyroxine absorption. Patients with elevated TSH levels following bariatric procedures are advised to switch from tablet levothyroxine to a liquid solution or crushed powder. Because the thyroxine dose may need to be reduced due to surgical weight loss, thyroid status needs to be monitored after all bariatric procedures.

## ACKNOWLEDGMENTS

The authors acknowledge the Texas Tech University Health Sciences Center Clinical Research Institute for assistance with this research.

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