

Impact of Preoperative Serum Vitamin D Level on Postoperative Complications and Excess Weight Loss After Gastric Bypass

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Abstract

Introduction The aim of this study was to determine the impact of hypovitaminosis D on Gastric Bypass outcomes.

Methods We retrospectively reviewed all patients who underwent primary intention Gastric Bypass in our center between January 2012 and December 2013. Postoperative complications, 1 and 2-year excess weight loss were compared between patients with and without hypovitaminosis D.

Results Among 258 patients who met inclusion criteria, 56 (21.7%) presented with vitamin D deficiency. Mean age was 41.73 ± 12.95 years. Mean BMI was 40.90 kg/m^2 (34–58 kg/m^2). No statistically significant difference in postoperative complication rate was found between patients with and without hypovitaminosis D. Mean 1-year excess weight loss was 75.24%. In patients with vitamin D deficiency mean 1-year excess weight loss was 71.90 versus 76.15% in patients with optimal serum vitamin D level ($p = 0.17$). No significant difference was found after a 2-year follow-up. In patients presenting with vitamin D insufficiency, 1-year excess weight loss was 75.64 versus 79.34% in patients with optimal serum vitamin D level ($p = 0.53$). After a 2-year follow-up, there was a significant difference between patients presenting with and without vitamin D insufficiency (79.45 versus 91.71%;

$p = 0.01$) and between patients presenting with and without hypovitaminosis D (80.50 versus 91.71%; $p = 0.01$).

Conclusion In our study, hypovitaminosis D seemed to have a negative impact on long term excess weight loss, but not on short-term outcome or postoperative complications. The role of systematic supplementation before bariatric surgery has to be explored in prospective studies.

Keywords Vitamin D · Hypovitaminosis D · Gastric bypass · Postoperative complications · Excess weight loss

Introduction

Vitamin D is a fat-soluble hormone. Sources of vitamin D are double in humans: exogenous (diet) and endogenous (photosynthesis) [1].

The prevalence of vitamin D deficiency and insufficiency is high in population-based studies [2]. Obesity is a well-known risk factor for hypovitaminosis D. In a cohort of morbidly obese patients seeking for Gastric Bypass surgery, serum vitamin D level $< \text{or} = 20 \text{ ng/ml}$ was found in 60% of candidates [3].

Vitamin D insufficiency has deleterious effects on surgical outcomes, such as higher postoperative hospital-acquired infections and surgical site-infection rate and higher in-hospital mortality [4–7]. After bariatric surgery, the risk of nosocomial infections was threefold greater in patients with hypovitaminosis D [8].

However, little is known about impact of vitamin D insufficiency or deficiency on weight loss after bariatric surgery.

The aim of our study was to determine preoperative hypovitaminosis D impact on postoperative complications and excess weight loss after Gastric Bypass surgery.

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Patients and Methods

We retrospectively reviewed all patients who underwent Gastric ByPass (GBP) surgery in order to treat morbid obesity in our center between January 2012 and December 2013.

All candidates for bariatric surgery must perform blood tests, including serum vitamin D dosage.

Inclusion and Exclusion Criteria

All patients older than 18 years who underwent GBP surgery were included.

We excluded secondary bariatric procedures and patients who performed their blood test in another laboratory.

Collected Data

We collected the following data: age, sex, preoperative weight, and body mass index (BMI), 1- and 2-year weight and BMI (in order to determine excess weight loss (EWL), serum vitamin D level (25(OH)D, ng/ml), associated comorbidities (diabetes mellitus, hypertension, dyslipidemia, obstructive sleep apnea), and postoperative complication (type and onset).

Surgical Procedure

All patients underwent laparoscopic Roux-en-Y GBP. A 12-mmHg pneumoperitoneum was obtained after insufflation through veress needle. The jejunum was divided 50 cm distal to the ligament of Treitz. A 150-cm excluded loop with a mechanical jejuno-jejunal anastomosis and a 20-ml gastric pouch were performed with hand-sewn gastro-jejunal anastomosis. Mesenteric and Petersen defects were systematically closed.

Definitions

Optimal serum vitamin D level corresponded to 30 ng/ml [1]. Vitamin D insufficiency was defined as serum vitamin level <20 ng/ml and vitamin D deficiency as serum vitamin D level <10 ng/ml.

Excess weight loss was calculated with the Lorentz formula [9].

Postoperative complications were considered following Clavien-Dindo classification and analyzed if they were \geq grade IIIa [10].

Endpoints

The primary endpoint was the presence of serious postoperative complications and 1- and 2-year excess weight loss (EWL).

Statistical Analysis

Data are expressed as mean \pm DS. Categorical variables were described by frequency distribution and compared across serum vitamin D level groups by using chi-square testing. A *t* test was performed to compare quantitative variables.

Statistical analyses were performed with R statistical software (R foundation for statistical computing).

Statistical significance was set as *p* value of less than 0.05.

Results

Of the 442 patients who underwent GBP surgery between January 2012 and December 2013, 258 were included as represented in Fig. 1. Other patients performed their blood test in another laboratory.

Population characteristics are shown in Table 1.

Of the 258 patients, 196 and 140 had complete follow-up 1 and 2 years postoperatively, respectively.

Vitamin D insufficiency was found in 176 patients (68%) and vitamin D deficiency in 56 patients (21.7%).

There were 39 (15.1%) postoperative complications. No in-hospital mortality was found. Postoperative complications are specified in Table 2. There was no significantly difference

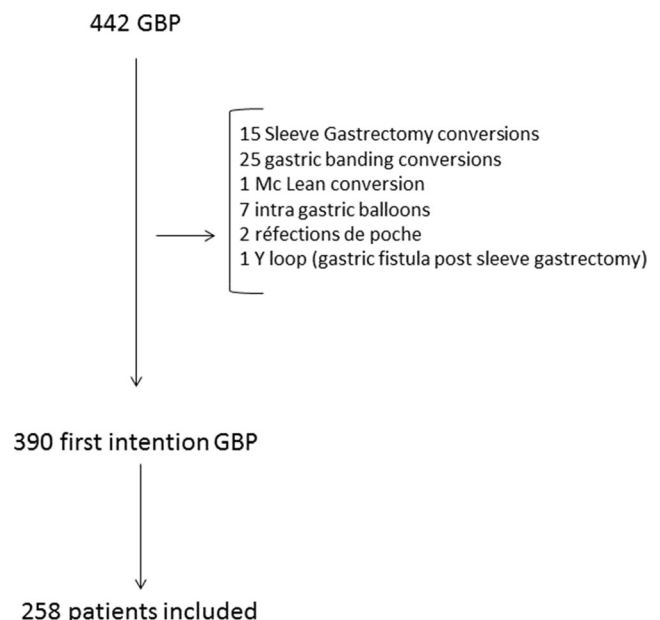


Fig. 1 Flow chart

Table 1 Population characteristics

Demographic data	All patients	>30 ng/ml	<30 ng/ml	10–30 ng/ml	>10 ng/ml	<10 ng/ml
Age (years) (mean ± SD)	41.73 ± 12.95	46.31 ± 13.74	41.21 ± 12.79	41.68 ± 12.53	42.28	39.73 ± 13.60
Sex (F)	226/258	24	202	155	179	47
BMI (kg/m ²) (mean)	40.90 (34–58)	39.52 ± 3.63	41.06 ± 3.82	40.73 ± 3.71	40.58	42.09 ± 4.03
DM <i>n</i> (%)	41 (15, 9%)	2	39	25	27	14
HTN <i>n</i> (%)	74 (28, 7%)	8	66	46	54	20
Obstructive sleep apnea <i>n</i> (%)	72 (27, 9%)	7	65	47	54	18
Dyslipidemia <i>n</i> (%)	41 (15, 9%)	6	35	27	33	8
Serum vitamin D (25(OH)D) (ng/ml) (mean ± SD)	18.25 ± 8.89	36.72 ± 5.96	16.18 ± 6.4	18.87 ± 4.60		7.74 ± 3.24
Postoperative complications (<i>n</i> (%))	39 (15, 1%)	7	32	25	32	7
1-year EWL (%)	75.24%	79.34	74.71	75.64	76.15	71.90
2-year EWL (%)	81.70%	91.71	80.50	79.45	81.11	83.98

BMI body mass index, DM diabetes mellitus, HTN hypertension, EWL excess weight loss

between patients with vitamin D insufficiency or deficiency and those with optimal serum vitamin D level when postoperative complications were concerned (Tables 3 and 4).

Mean 1 and 2 years excess weight loss were 75.24 and 81.70%, respectively. No significant difference was found between 1-year EWL in patients with and without hypovitaminosis D. After a 2-year follow-up, patients presenting with vitamin D insufficiency had a significantly lower EWL than patients with optimal serum vitamin D level (79.45 versus 91.71%; $p = 0.01$) (Table 4).

Comparison between patients with optimal vitamin D serum level and with vitamin D deficiency is shown in Table 5. No significant difference was found between these groups.

Table 6 represents comparison between patients with optimal vitamin D serum level and with insufficiency and deficiency. After a 2-year follow-up, patients presenting with vitamin D insufficiency and deficiency had a significantly lower EWL than patients with optimal serum vitamin D level (80.50 versus 91.71%; $p = 0.01$).

Discussion

In our cohort study, serious postoperative complications and hypovitaminosis D were not significantly

associated. However, we found a negative effect of vitamin D insufficiency on 2-year excess weight loss after GBP surgery.

Hypovitaminosis D is frequent in population-based studies [1]. Its prevalence is higher in obese patients, rising up to 90% in several studies [11] when considering vitamin level < or = 30 ng/ml. In our cohort, vitamin D insufficiency was found in 176 patients (68%) and vitamin D deficiency in 56 patients (21.7%). These rates are compatible with already published data. The greater prevalence of hypovitaminosis D in obese patients is explained by several factors such as sequestration of vitamin D in adipose tissue [12, 13], impaired vitamin D liver synthesis on account of liver function alteration [14], or increased vitamin D clearance by chronic inflammatory status [15].

Our study failed to find any association between hypovitaminosis D and serious postoperative complications. It can be explained by having few cases in complications group (39 patients), which may be insufficient to underscore difference. Most of published series related infectious complications, but the link between hypovitaminosis D and specific complications of bariatric surgery is not established. Here, we reported anastomotic complications (such as fistula or stenosis) or biliary lithiasis, which are known to be frequent after

Table 2 Postoperative complications

Complications	>30 ng/ml	10–30 ng/ml	<10 ng/ml
Anastomotic leak	7	2	4
Pulmonary infection	3	1	2
Anastomotic ulcer	9	2	5
Anastomotic stricture	6	1	4
Gallbladder stones	14	1	10
Total	39	7	25

Table 3 Endpoints compared between patients with and without vitamin D deficiency

	Serum vitamin D <10 ng/ml	Serum vitamin D >10 ng/ml	<i>p</i>
Postoperative complications	7	32	0.54
1-year EWL	71.90	76.15	0.17
2-year EWL	83.98	81.11	0.43

Table 4 Endpoints compared between patients with and without vitamin D insufficiency

	Serum vitamin D between 10 and 30 ng/ml	Serum vitamin D >30 ng/ml	<i>p</i>
Postoperative complications	25	7	0.14
1-year EWL	75.64	79.34	0.53
2-year EWL	79.45	91.71	0.01

p* < 0.05Table 5** Endpoints compared between patients with vitamin D deficiency and patients with optimal serum vitamin D level

	Serum vitamin D <10 ng/ml	Serum vitamin D >30 ng/ml	<i>p</i>
Postoperative complications	7	7	0.12
1-year EWL	71.90	79.34	0.23
2-year EWL	83.98	91.71	0.14

bariatric surgery. In our cohort, infectious complications were uncommon, which can explain the absence of association.

In this study, we underscored association between vitamin D insufficiency and lower 2-year EWL. Little is known about weight loss predictive factors. A previous study evaluates the impact of fat-free mass on EWL. EWL was positively correlated with fat-free mass [16]. As vitamin D is stored in adipose tissue, we can extrapolate that serum vitamin D level is higher in patients with an important fat-free mass and explain our data.

On account of the small effective of our cohort, these results must be confirmed by larger studies, especially with prospective and controlled trials.

Table 6 Endpoints compared between patients with serum vitamin D level >30 ng/ml and <30 ng/ml

	Serum vitamin D <30 ng/ml	Serum vitamin D >30 ng/ml	<i>p</i>
Postoperative complications	32	7	0.12
1-year EWL	74.41	79.34	0.39
2-year EWL	80.50	91.71	0.01*

**p* < 0.05

Conclusion

In this study, we emphasized an association between vitamin D insufficiency and 2-year EWL but we failed underscoring a short-term impact of hypovitaminosis D on EWL or postoperative complications.

Prospective studies must confirm this data and assess impact of systematic oral vitamin D supplementation before bariatric surgery.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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