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Prevalence of nutrient deficiencies in bariatric patients

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Abstract

Objective: The aims of this study were to determine the prevalence of nutrient deficiencies in patients who present for bariatric surgery, assess nutritional status after surgery, and compare these with preoperative levels.

Methods: A retrospective study was conducted to identify preoperative and 1-year postoperative nutrition deficiencies in patients undergoing bariatric surgery. The screening included serum ferritin, vitamin D, vitamin B_{12}, homocysteine, folate, red blood cell folate, and hemoglobin. Results were available for 232 patients preoperatively and 149 patients postoperatively. Two-tailed χ^2 tests and paired-sample *t* tests were used.

Results: Preoperatively, vitamin D deficiency was noted at 57%. The prevalence of abnormalities 1 year after roux-en-Y gastric bypass was higher compared with preoperative levels ($P < .05$). After surgery, anemia was detected in 17%, elevated homocysteine levels (women only) in 29%, low ferritin in 15%, low vitamin B_{12} in 11%, and low RBC folate in 12%. Mean hemoglobin, ferritin, and RBC folate levels deteriorated significantly but remained well within normal ranges. The prevalence of vitamin D deficiencies decreased, but not significantly. In sleeve gastrectomy patients, mean ferritin levels decreased ($P < .05$), without any patient developing a deficiency.

Conclusion: Vitamin D deficiency is common among morbidly obese patients seeking bariatric surgery. Because the prevalence of micronutrient deficiencies persists or worsens postoperatively, routine nutrition screening, recommendation of appropriate supplements, and monitoring adherence are imperative in this population. Crown Copyright © 2009 Published by Elsevier Inc. All rights reserved.

Keywords: Obesity; Bariatric surgery; Roux-en-Y gastric bypass; Sleeve gastrectomy; Gastric banding; Nutrient deficiency; Vitamin D

Introduction

Bariatric surgery has been recognized to be the most effective long-term treatment for the morbidly obese (body mass index [BMI] ≥ 40 kg/m^2), with demonstrated significant and durable weight loss, resolution or improvement of comorbidities [1,2], and subsequent reduction in mortality [3,4].

Bariatric procedures produce changes in the gastrointestinal anatomy and physiology. As a consequence, there is a change in the quantity and quality of diet, which may result in vitamin and mineral deficiencies [5]. Studies examining preoperative and postoperative nutritional status are few, and the reported prevalence of these deficiencies varies widely because of varying definitions of deficiency, patient populations, surgical techniques, supplement protocols, and lengths and completion of patient follow-up [5]. Furthermore, studies have shown that calcium, vitamin D, and iron deficiencies, as well as hyperparathyroidism, are prevalent among the morbidly obese before bariatric surgery [6]. Given the paucity of data exploring nutritional status among bariatric populations and the likely elevated risk for nutritional deficiencies, nutrition screening and treatment protocols appear important. These protocols will need to vary depending on the chosen bariatric procedure.

The 3 types of bariatric surgery done at our hospital are adjustable gastric banding (AGB), Roux-en-Y gastric bypass

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(RYGB), and sleeve gastrectomy (SG). Nutrition screening is carried out routinely before surgery, as well as 6 months, 9 months, and 1 year after surgery. The aims of this study were to determine the prevalence of nutrient deficiencies in patients who present for bariatric surgery and to assess nutritional parameters 1 year after surgery and compare these with preoperative levels.

Materials and methods

A retrospective study was carried out on 244 consecutive patients who had undergone laparoscopic bariatric surgery by a single surgeon (J.J.) at St. George Hospital (Sydney, Australia) between February 2005 and June 2007. There were 55 AGB, 124 RYGB, and 65 SG surgeries. All patients are seen by a dietitian for routine nutrition assessment and counseling before and after surgery. The postoperative protocol involved instructing all patients to take a liquid, effervescent, or chewable multivitamin and mineral supplement daily and, for RYGB patients, additional calcium citrate 1500 mg, vitamin B_{12} 1000-μg injections every 3 to 6 months, and iron supplements if biochemically deficient.

Preoperative and 1-year postoperative biochemistry results were obtained from patients' medical notes; they were available for 232 patients (47 AGB, 121 RYGB, and 64 SG) preoperatively. Biochemistry results collected were serum albumin, iron, ferritin, 25-hydroxy-vitamin D (25[OH]D), vitamin B_{12}, parathyroid hormone (iPTH), homocysteine (tHcy), C-reactive protein, urea, creatinine, folate, red blood cell (RBC) folate, and hemoglobin (Hb).

Analysis of data was performed on available results using SPSS version 15.0 (SPSS, Inc., Chicago, IL), with statistical significance set at $\alpha = 0.05$. Two-tailed χ^2 tests were used to compare the prevalence of abnormalities before and after surgery. Differences between nutritional parameters before and after surgery were examined using paired-sample *t* tests when distributions were normal and Wilcoxon's signed-rank test for nonparametric distributions. To determine the significance of the linear associations between age and BMI with selected biochemistry levels, Pearson's correlation was used for normally distributed variables and Spearman's ρ for non-normally distributed variables.

The study protocol was approved by the Southern Sydney and Illawarra Area Health Service Human Research Ethics Committee.

Results

Subjects' characteristics are shown in Table 1. The majority of patients (64%) were women, mostly aged 30 to 60 years (mean age, 46 ± 11 years). Nearly all patients had BMIs ≥ 35 kg/m^2. In 10 patients (6 of whom underwent RYGB), BMIs were between 30 and 34.9 kg/m^2, and the indication for surgery was the treatment of insulin resistance or diabetes mellitus. Percentage excess weight loss was not one of the key outcome measures in this study, so it is reported only for patients who had biochemical results available 1 year postoperatively.

Preoperative abnormalities

Table 2 shows the prevalence of preoperative abnormalities. There was a high prevalence (57% [24 of 42 patients]) of vitamin D deficiency, although mostly mild (45% [19 of 42 patients]), among the patients. Age and BMI were not significantly associated with 25(OH)D levels. Elevated iPTH was found in 25% of patients but was not significantly correlated with 25(OH)D levels.

Low serum iron levels appeared in almost 16% of patients and were significantly more prevalent among women than men (21.7% vs 4.6%; $P = .005$). Low iron stores, reflected by ferritin levels, were uncommon (1% [2 patients, both women]). The prevalence of anemia was low (6.4%). Of the 14 anemic patients, only 5 had documented anemic indices, 3 of whom had microcytic indices.

A low percentage of patients (<6%) had folate deficiencies, as determined by RBC folate, and vitamin B_{12} deficiencies were even less common (<2%). Although elevated tHcy levels were more than twice as common among men as women (12.7% vs 5.3%), this was not statistically significant ($P = .08$).

Preoperative and postoperative prevalence of abnormalities

A total of 183 patients (34 AGB, 103 RYGB, 46 SG) were eligible for the 1-year postoperative data collection. In the

Table 1
Subject characteristics

Characteristic	Total (n = 232)	AGB (n = 47)	RYGB (n = 121)	SG (n = 64)
Men/women	83/149	12/35	44/77	27/37
Age (y)	46 ± 11 (20–74)	40 ± 11 (20–60)	48 ± 10 (24–66)	46 ± 12 (20–74)
BMI (kg/m^2)	45.2 ± 8.3 (30.3–81.7)	42.9 ± 6.6 (30.9–59.9)	43.1 ± 5.2 (30.3–53.6)	51.0 ± 11.2 (33.1–81.7)
Months at 1 y	NA	11 ± 2.6 (7–15)	10 ± 2.9 (6–16)	12 ± 3.6 (6–17)
%EWL at 1 y*	NA	46.0 ± 27.8 (4.6–76.8)	73.2 ± 22.5 (4.0–123.0)	44.3 ± 15.6 (10.9–83.3)

Data are expressed as number of patients or as mean ± SD (range).

AGB, adjustable gastric banding; BMI, body mass index; EWL, excess weight loss; NA, not applicable; RYGB, Roux-en-Y gastric bypass; SG, sleeve gastrectomy.

* Reported only for patients who had biochemical results available 1 year after surgery.

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