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Hair loss in sleeve gastrectomy subjects: effects of designed supplements for nutritional deficiencies

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Abstract

Aim: Hair loss is a common complication after bariatric surgery that is related to nutritional deficiencies. The aim of this study was to evaluate the prevalence of micronutrient deficiencies preoperative and postoperative and their relationship with hair loss 12 months after bariatric surgery (BS) in those younger and older than 45 years of age, with or without a prescription for supplements.

Methods: In this prospective study, performed between 2018 and 2020 on patients undergoing laparoscopic sleeve gastrectomy (LSG) (not generally BS) in our hospital, the patients were categorized into two main groups of with or without a prescription for supplements. In addition, each main group was divided into age subgroups. Then, complete clinical and biological nutritional assessments were performed in these four subgroups, before and after surgery. Hair loss related to nutritional deficiencies were systematically recorded at 12 months after LSG.

Results: In total, 1224 patients undergoing LSG were enrolled into the study. Nutritional deficits in some variables were even tripled after LSG in both the younger and older groups without a prescription for supplements. In the group with a prescription for supplements, nutritional deficiencies declined postoperatively. The postoperative deficits in the group without a prescription for supplements were frequently in iron (41.83% for younger group; 44.44% for older group) and zinc (42.15% for younger group; 43.79% for older group). In the group with a prescription for supplements, hair loss was less common than in the group without a prescription for supplements postoperatively.

Conclusion: Preoperative monitoring of the combination of several nutritional deficits could be used to identify patients at risk and prevent the onset of deficiencies and their consequences after BS. Identification and correction of micronutrient deficiencies were essential for treating hair loss.

Keywords: Sleeve gastrectomy, hair loss, older ages

INTRODUCTION

The prevalence of obesity, over the last three decades, has tripled with an estimated 13% of adults being obese in 2016[1]. Obesity is not only a cosmetic concern but also a medical problem that increases the risk of other diseases, such as diabetes, atherosclerotic cardiovascular diseases, high blood pressure, and some kinds of cancers[2-5]. According to the World Health Organization (WHO), obesity is defined as "abnormal or excessive fat accumulation that presents a risk to health"[6]. Obesity results from a combination of inherited factors, environmental and socioeconomic factors, personal diet, and exercise choices[7].

Bariatric surgery has evolved in the United States and worldwide over the past two decades and is done to help patients lose excess weight and reduce the risk of potentially life-threatening weight-related health problems. Bariatric surgery is a method of treatment that can be used in the case of patients with BMI ≥ 35 kg/m^2 and coexisting complications of obesity, such as arterial hypertension, or with BMI ≥ 40 kg/m^2 for normal individuals[8]. The two most commonly performed bariatric surgery procedures are Roux-en-Y gastric bypass and sleeve gastrectomy (SG)[9-11]. However, these methods are not free from complications, and the most common ones are micronutrient deficiencies because of preoperative malnutrition, decreased food intake due to reduced hunger, and increased satiety and food intolerance or vomiting[12]. Some of these deficiencies cause severe clinical impacts, including neurological complications, anemias, bone demineralization, and protein malnutrition[13-15]. Moreover, many patients have symptoms suggestive of nutritional deficiencies after BS, but there are few prospective studies to specify their prevalence after surgery[13-16]. The frequently reported complications in studies are hair loss, cramps, and paresthesia. These symptoms are more frequent in subjects who are noncompliant to medical visits in the long term after surgery[11].

The main aim of our study was to assess the link between symptoms suggestive of nutritional deficiencies such as hair loss and a large panel of nutritional parameters in subjects who underwent bariatric surgery.

METHODS

In this prospective study performed on LSG candidates from 2018 to 2020, we included consecutive male and female subjects who underwent LSG at our institution and with complete clinical and biological nutritional assessments performed in Erfan Hospital. The subjects were studied were divided into those younger and older than 45 years of age, with or without a prescription for supplements. Multivitamin supplements were systematically prescribed after surgery, and the reference ranges were recommended by the dietetics and nutritional experts based on age and gender. Hair loss related to nutritional deficiencies was systematically recorded at the 12-month follow-up visit after LSG. Hair loss was defined as either an enhanced amount of hair falling out daily (effluvium) or visible hairlessness (alopecia). Normal hair loss (normal shedding) was referred to the loss of up to 100 hairs per day. Biological parameters (including vitamins B1, B12, C, A, E, and D and minerals iron, folic acid, biotin, riboflavin, zinc, and selenium) were assessed using routine techniques[11,17,18]. 25-hydroxy vitamin D was assayed with a liquid chromatography-tandem mass spectrometry method (Waters Ltd., Elstree, UK). Vitamins A and E were carried out using a high-performance liquid chromatography technique (Agilent Corporation, Santa Clara, CA, USA). Trace

elements were measured using inductively coupled plasma mass spectrometry (Agilent). Other routine chemistry and hematology analyses were measured on automated platforms (Abbott Diagnostics, Maidenhead, UK; Hobira Medical, Montpellier, France respectively). The daily doses of supplements for patients younger than 45 years of age include: 8 mg of iron for men and post-menopausal women, 18 mg of iron for menstruating women, 30 µg of biotin, 11 mg of zinc for men and 8 mg of zing for women, 55 µg selenium, 400 µg of folic acid, 2.4 µg of riboflavin and vitamin B12, 1.2 mg of vitamin B1 for men and 1.1 mg of vitamin B1 for women, 900 mcg of vitamin A for men and 700 mcg of vitamin A for women, 15 mg of vitamin E, 45 mg of vitamin C, and 15 mcg of vitamin D. The only differences in the daily doses of supplements in subjects older than 45 years of age were for iron and zinc, which were prescribed at 18 and 11 mg, respectively. More details on the composition of the multivitamin supplement are given in Table 1. Patients initiated supplementation two weeks after surgery and continued for two months. Compliance with supplementation was carefully assessed by the medical follow-up team. This study obtained the ethic code EN2H11935642287TA through the Ethical Board of Erfan Niayesh Hospital.

Surgical technique

All LSG procedures were carried out by a longitudinal resection from the angle of His to around 3-4 cm orally to the pylorus using a 36-French bougie inserted along the lesser curve. More details on surgical technique have been published previously[19].

Statistical analysis

All descriptive findings are presented as mean/median and standard deviation for quantitative variables and count and percentage for qualitative variables. After checking the normality of variables using histogram graphs and the Kolmogorov-Smirnov test, the Wilcoxon rank test was used to compare the non-parametric variables and *t*-test to compare other continuous variables before and after LSG. The statistical significance level was defined as 0.05 ($\alpha = 0.05$). The statistical analyses were performed using IBM SPSS Statistics 25 (SPSS Inc., Chicago, IL).

RESULTS

For all sleeve gastrectomy candidates in our center, we routinely invited patients to participate in this study. We tried to distribute subjects equally into two groups of males and females and two subgroups of those younger and older than 45 years of age. Of 1224 patients, 612 cases were females (50.0%) and 612 subjects were males (50.0%), ranging from 21 to 75 years of age with 612 (50.0%) under 45 years and 612 (50.0%) over 45 years.

Prevalence of preoperative nutritional deficiencies

Nutritional deficiencies are common issues in morbidly obese subjects. In this prospective study, we recorded every potential deficiency in micronutrients at the first visit before surgery. The most prevalent micronutrients with deficiency in those younger than 45 years were iron (29.9%), vitamin D (28.1%), zinc (27.94%), vitamin A (24.01%), and vitamin C (20.9%). Among those older than 45 years, zinc (27.94%), iron (25.98%), vitamin A (25.81%), vitamin E (25%), vitamin C (23.69%), and vitamin D (23.03%) were the most common deficits before surgery.

Prevalence of postoperative nutritional deficiencies

Nutritional deficits were observed after BS in both age groups without a prescription for supplements (first group, younger than 45 years of age; second group, older than 45 years of age) [Table 1]. Deficits in the group without a prescription for supplements were frequently in iron (41.83% for first group; 44.44% for second group), zinc (42.15% for first group; 43.79% for second group), and vitamin A (61.76% for first group; 58.82% for second group). In the group with a prescription for supplements, nutritional deficiencies

Table 1. Prevalence of micronutrient deficiencies in those younger and older than 45 years of age, with or without a prescription for supplements before surgery and at 12 months after LSG

Variables	Normal levels of micronutrients in normal individuals	Younger than 45 years of age					Older than 45 years of age				
		Pre operative deficiency	Post operative deficiency without supplement	Supplements dose - daily intake	Post operative deficiency with supplement	*P*-value[1]	Pre operative deficiency	Post operative deficiency without supplement	Supplements dose - daily intake	Post operative deficiency with supplement	*P*-value[2]
n	-	612	306	-	306	-	612	306	-	306	-
Iron	M: 80-180 mcg/dL F: 60-160 mcg/dL	183 (29.9%)	128 (41.83%)	Men and post-menopausal women: 8 mg Menstruating females: 18 mg	85 (27.77%)	0.00026*	159 (25.98%)	136 (44.44%)	18 mg	77 (25.16%)	< 0.00001*
Biotin	133-329 pmol/L	60 (9.8%)	103 (33.66%)	30 µg	48 (15.68%)	< 0.00001*	66 (10.78%)	116 (37.9%)	30 µg	32 (10.45%)	< 0.00001*
Zinc	0.66-1.10 mcg/mL	171 (27.94%)	129 (42.15%)	M: 11 mg F: 8 mg	58 (18.95%)	< 0.00001*	171 (27.94%)	134 (43.79%)	11 mg	55 (17.94%)	< 0.00001*
Selenium	70-150 ng/mL	84 (13.72%)	52 (16.99%)	55 µg	45 (14.7%)	0.4413	91 (14.86%)	61 (19.93%)	55 µg	48 (15.68%)	0.1706
Folic acid	2.7-17.0 ng/mL	48 (7.84%)	39 (12.74%)	400 µg	27 (8.82%)	0.1187	55 (8.98%)	42 (13.72%)	400 µg	25 (8.16%)	0.0278*
Riboflavin	4-24 µg/dL	74 (12.09%)	41 (13.39%)	2.4 µg	33 (10.78%)	0.3221	79 (12.90%)	46 (15.03%)	2.4 µg	26 (8.49%)	0.0120*
Vitamin B12	200-900 pg/mL	72 (11.76%)	42 (13.72%)	2.4 µg	24 (7.84%)	0.018*	96 (15.68%)	60 (19.6%)	2.4 µg	39 (12.74%)	0.0208*
Vitamin B1	2.5-7.5 µg/dL	18 (2.94%)	18 (5.88%)	M: 1.2 mg F: 1.1 mg	6 (1.96%)	0.012*	23 (3.75%)	25 (8.16%)	M: 1.2 mg F: 1.1 mg	15 (4.9%)	0.101
Vitamin A	20-60 mcg/dL	147 (24.01%)	189 (61.76%)	M: 900 mcg F: 700 mcg	97 (31.69%)	< 0.00001*	158 (25.81%)	180 (58.82%)	M: 900 mcg F: 700 mcg	82 (26.79%)	< 0.00001*
Vitamin E	5.5-17 µg/mL	14 (2.28%)	100 (32.67%)	15 mg	59 (19.28%)	0.00016*	153 (25%)	97 (31.69%)	15 mg	43 (14.05%)	< 0.00001*
Vitamin C	0.6-2 mg/dL	128 (20.91%)	97 (31.69%)	45 mg	70 (22.87%)	0.014*	145 (23.69%)	94 (30.71%)	45 mg	67 (21.89%)	0.01314*
Vitamin D	20-40 ng/mL	172 (28.1%)	104 (33.98%)	15 mcg	41 (13.39%)	< 0.00001*	141 (23.03%)	150 (49.01%)	20 mcg	66 (21.56%)	< 0.00001*

**P*-value significant at 0.05. [1]*P*-value for statistical analysis of variables between the two subgroups of patients who received supplements and patients who did not receive supplements in the younger than 45 years group. [2]*P*-value for statistical analysis of variables between the two subgroups of patients who received supplements and patients who did not receive supplements in the older than 45 years group.

were not only better than in the group without a prescription for supplements postoperative, but also better than their evaluations preoperatively [Table 1]. Prevalent nutritional deficiencies in the group with a prescription for supplements were in vitamin A (31.69% for first group; 26.79% for second group; $P = 0.4354$), iron (27.77% for first group; 25.16% for second group; $P = 0.7489$), vitamin C (22.87% for first group; 21.89% for second group; $P = 0.7718$), and vitamin E (19.28% for first group; 14.05% for second group; $P = 0.08186$); the *P*-values for these variables in the groups of those younger and older than 45 years which received supplements mentioned above were not statistically significant. The analysis of the data revealed that the reduction of nutritional

deficiencies in some variables such as iron ($P = 0.00026$), biotin ($P < 0.00001$), zinc ($P < 0.00001$), vitamin B12 ($P = 0.018$), vitamin B1 ($P = 0.012$), vitamin A ($P < 0.00001$), vitamin E ($P = 0.00016$), vitamin C ($P = 0.014$), and vitamin D ($P < 0.00001$) was significant for patients younger than 45 years of age who received or did not receive supplements. In those older than 45 years, in addition to those variables, folic acid ($P = 0.0278$) and riboflavin ($P = 0.012$) were statistically significant among subjects with or without supplements [Table 1].

Relationship between hair loss and nutritional parameters

Subjects who complained of hair loss (effluvium or alopecia) were mostly postoperative women without a prescription for supplements (53% in the younger group; 58% in the older group), and in the older group without a prescription for supplements hair loss was also more frequent and statistically significant (82% in total) in comparison with the younger group without a prescription for supplements (69% in total) postoperatively ($P = 0.03236$) [Figure 1]. In the group with a prescription for supplements, the rate of hair loss was lower than in the group without a prescription for supplements (40% overall in the younger group; 36% overall in the older group) postoperatively [Figure 1]. The prevalence of hair loss regardless of age and gender among subjects with or without a prescription for supplements was significant at $P < 0.00001$.

DISCUSSION

After BS, many subjects complain of symptoms suggestive of nutritional deficiencies, the most frequently reported being hair loss, cramps, and paresthesia. Postoperative symptoms do not result in severe health consequences; they cause a daily discomfort for patients. Hair loss is a common complication after bariatric surgery and is reported in more than half of the subjects in the short term after BS. Hair loss is related to rapid weight reduction; furthermore, zinc, iron, and other micronutrient deficiencies can also be involved[16,17]. There are only a few data on the treatment of these symptoms[18]. Treatment of hair loss with vitamins B5 and B6 is common after BS, whereas there are no data on the association between hair loss after BS and deficits in these vitamins[11]. This is the main reason for our study that aimed to determine the main deficiencies that underlie hair loss and their treatment with supplements after BS.

The frequently reported nutritional deficiencies after BS are iron, vitamin B12, vitamin D, vitamin B1, and zinc deficits[10,11,20-23]. In our study, vitamin A, iron, and zinc deficits were the most frequently observed after BS. Indeed, we observed a higher prevalence of vitamin A, iron, and zinc deficits in both groups (those younger and older than 45 years of age) without a prescription for supplements compared to both groups with a prescription for supplements.

The analysis of patients with and without a prescription for supplements indicated significant differences for hair loss between the groups with and without hair loss concerning the postoperative use of supplements. The prevalence of hair loss was 69% and 82% in the younger and older groups, respectively, 12 months after BS, which is in line with previous reports[24,25]. By using the supplements postoperatively, the prevalence of hair loss was only 40% and 36% in the younger and older groups, respectively.

Preoperative monitoring of the combination of several nutritional deficits could be used to identify patients at risk and prevent the onset of deficiencies and their consequences after BS[26]. Identification and correction of micronutrient deficiencies was essential for treating hair loss. Our patients stated they benefited from supplements. Indeed, most patients stopped losing hair after being prescribed vitamin and mineral supplements one year after BS. As a consequence, diet counseling and adequate supplementation are required after BS to avoid hair loss. Postoperatively, all patients should receive lifelong supplementation.

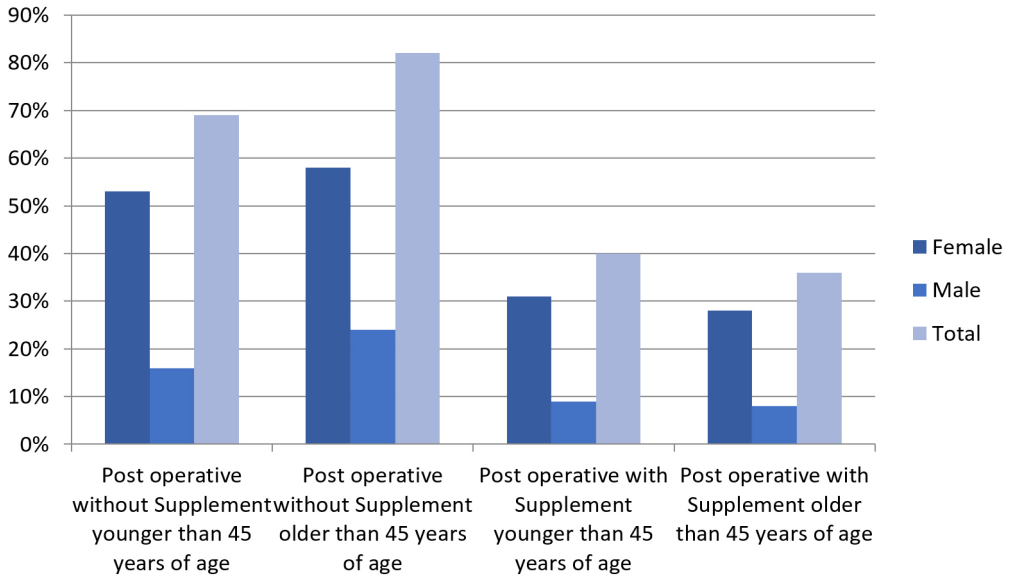

Figure 1. Prevalence of hair loss 12 months after bariatric surgery in those younger and older than 45 years of age, with or without a prescription for supplements. The prevalence of hair loss regardless of age and gender among subjects with or without a prescription for supplements was significant at $P < 0.00001$.

In conclusion, hair loss is a frequent postoperative complication after BS in morbidly obese individuals. Based on the results, the variable addition zinc + iron might be one of the predictors of hair loss, although further research is needed to demonstrate the correlation between preoperative status of nutritional deficiency and postoperative remission in bariatric subjects. Therefore, there is global need for monitoring nutrient status in these patients. Most of these deficiencies might be preventable and treatable with high-dose supplementation. With increased awareness of the potential nutritional consequences of BS, life-threatening complications related to nutritional deficits may be avoided.

DECLARATIONS

Authors' contributions

Study designe: Anbara T, Kheirvari M
Data cquisition: Anbara T, Kheirvari M
Data analysis: Kheirvari M
Manuscript preparation: Kheirvari M
Supervision: Anbara T

Availability of data and materials

Readers can reach the data and materials through direct contact to authors' emails.

Financial support and sponsorship

None.

Conflict of interest

Both authors declare that there are no conflicts of interest.

Ethical approval and consent to participate

This study obtained the ethic code EN2H11935642287TA through the Ethical Board of Erfan Niayesh Hospital. Informed consent was obtained from all individual participants included in the study.

Consent for publication

Not applicable.

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