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Malnutrition secondary to non-compliance with vitamin and mineral supplements after gastric bypass surgery: What can we do about it?

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Summary

Background:	Nutritional deficiency due to loss of follow up and non-compliance with routine mineral and multivitamin supplements is not uncommonly encountered following bariatric surgery. In this report, and utilizing a case study, we will address issues related to loss of long term medical follow up and the measures that can be taken to prevent it in this patient population.
Case Report:	The case of a 38-year-old female patient who was recently managed for severe vitamin deficiency and iron deficiency anemia following bariatric surgery is presented. Non-compliance with routine vitamin and mineral supplements was believed to be the main culprit of her condition. Articles published in English addressing issues related to non-compliance with supplementations and regular follow up after bariatric surgery were accessed from PubMed and are discussed.
Conclusions:	Multiple factors affecting long term follow up and compliance have been studied including age, financial costs, distance from the clinic and psychiatric co-morbidities. Preventive measures have also been tested and some of them have shown significant benefit. More research is needed to identify other modifiable factors and preventive measures influencing compliance and long term follow up following bariatric surgery.
key words:	nutritional deficiency • gastric bypass • compliance

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BACKGROUND

Today bariatric surgery is the only treatment option for a substantial and durable long-term weight loss [1]. Unfortunately, obesity prevalence is increasing worldwide leading to an increase in the number of bariatric operations performed. As a consequence, an increasing number of patients are presenting with medical and nutritional complications [2].

Bariatric surgery candidates are at risk of developing vitamin and mineral nutritional deficiencies in the post-operative stage due to several factors, including decrease in food intake, vomiting, diminution of gastric secretions and bypass of absorption area [3,4]. Therefore, Daily multivitamin supplementation is necessary for optimal patient care following bariatric surgery [5,6], and should be individualized to patients based on their periodic laboratory tests and nutritional needs [7].

For all patients undergoing bariatric surgery, education and close follow-up to prevent and detect nutritional deficiencies are important. Here we describe a case of a non-compliant patient who failed to maintain regular follow-up after undergoing bariatric surgery leading to severe vitamin and mineral deficiencies managed by a multidisciplinary approach. The primary aim of this review is to outline the issues related to loss of long-term medical follow up after bariatric surgery, in particular failure to comply with recommended multivitamin and mineral therapy leading to nutritional deficiency and to discuss potential strategies to improve compliance and prevent malnutrition. The secondary aim is to highlight gaps in the literature and to identify areas of ambiguity where further research is required.

CASE REPORT

A 38-year-old female with morbid obesity underwent Roux-en-y gastric bypass surgery at University of Missouri Health System, Columbia, MO five years prior to her most recent presentation. Her operation was un-complicated and she was prescribed a standard treatment of multivitamins upon discharge from the hospital. She was poorly compliant

with her vitamin supplements and didn't show up to clinic appointments.

The patient presented to our institution recently, complaining from generalized fatigue and weakness. On examination, she had lost almost 47 kilograms (105 pounds) from day of operation. She was pale and had a soft ejection systolic murmur grade 2/6. The physical examination was otherwise unremarkable. Her laboratory tests in the emergency department included hemoglobin of 4.7 g/dL (normal range, 12 to 16 g/dL) with a hematocrit of 15% (normal range, 37% to 47%) and a mean corpuscular volume (MCV) of 63.6 fL (normal range, 80 to 96 fL). At this point, the patient was admitted for further evaluation and management of anemia. She received a transfusion of 4 units of packed red blood cells, which brought her hemoglobin up to 8.1 g/dL and hematocrit to 25%.

The patient's anemia was initially attributed to iron deficiency, given her history of bariatric surgery and low MCV. However, due to her history of non-compliance; further laboratory tests along with iron studies were done including vitamin B12, vitamin B1 (serum thiamine), vitamin D and Zinc. Interpretation of her laboratory tests revealed marked mineral and vitamin deficiencies which were thought to be contributing to her anemia as well. Her biochemical characteristics are summarized in (Table 1) along with the therapy provided during her hospitalization.

Counseling regarding the crucial benefits from long term follow-up and compliance with vitamin supplements was provided by the admitting team. Social workers were involved from the beginning to address financial issues that might have contributed to her non-compliance and psychiatric referral was provided for further counseling and evaluation. She was discharged to complete an IV iron supplementation course as an outpatient, and to follow with bariatric surgery multidisciplinary center for monitoring of her nutritional status.

Two weeks following discharge the patient was seen at bariatric surgery clinic, she denied any new complaints and felt subjectively stronger compared to day of admission.

Table 1. Biochemical characteristics on admission and after 3 months.

Labs performed during hospitalization and follow up visit	Level on day of admission	Level after 3 months	Reference range	Therapy provided
Vitamin B12 (pg/mL)	118	614	211–946	Cyanocobalamin 1000 mcg IM daily for 7 days and then weekly for 4 months
Vitamin D 25 Hydroxy (ng/mL)	4	23	30–80	Cholecalciferol 2,000 IU daily PO
Zinc (mcg/dL)	48	87	60–120	Celebrate bariatric vitamin 1 tab BID (contains 15 mg zinc, 100% of daily value)
Vitamin B1, plasma (nmol/L)	4	NA	8–30	Celebrate bariatric vitamin 1 tab BID (contains 12 mg thiamin, 800% of daily value)
Vitamin B1, whole blood (nmol/L)	NA	94	70–180	
Iron (mcg/dL)	6	40	37–145	Sodium ferric gluconate complex 125 mg IV once weekly for 3 doses and Celebrate Iron 1 tab QD (contains 18 mg iron, 100% of daily value)
Ferritin (ng/mL)	7.9	8.1	13–150	
TIBC (mcg/dL)	500	495	149–491	

TIBC – total iron binding capacity; NA – not available.

Counseling regarding the need of regular follow up and the importance of vitamin supplements was performed. The patient was provided with an informational handout that outlined vitamin supplementation following bariatric surgery along with written information that included how to obtain bariatric vitamins via website, phone and from pharmacies. The patient was informed that vitamins are required for life after bariatric surgery and follow up labs will have to be drawn to insure that appropriate dosages are being provided.

Three months following discharge the patient was seen at her primary care physician's office. Compliance with vitamin supplements was confirmed by history, and she was asked to keep a food journal for further evaluation of her diet practices. Laboratory tests showed an increase in Hgb to 10.8 g/dL and hematocrit to 32%. Improvement in her vitamins and mineral deficiency status was also found as illustrated in (Table 1).

DISCUSSION

Gastric bypass surgery is associated with serious vitamin deficiencies. Hence, vitamin supplementation should be continued for life, and even patients on regular supplements should be closely monitored for vitamin deficiencies [3]. The patient under discussion was admitted with severe anemia that was mainly attributed to her poor compliance with vitamin supplements and failure to maintain regular follow-up after the surgery.

The major issues related to non-compliance and loss of follow up are summarized here based on the recently published studies and expert opinions. However, consensus is still lacking on many issues, probably because the impact of these factors on post surgical weight loss has not been adequately studied. Also, there are no evidence-based guidelines for an optimal postoperative follow up strategy.

High risk groups and situations

Adolescents

Gastric bypass is now considered a safe procedure and an effective means to treat obesity-related morbidity in adolescents [8]. To prevent postoperative complication, a multidisciplinary team of experienced medical and surgical specialists is needed for optimal preoperative decision making and postoperative management and long-term follow-up [9,10]. It has been suggested that compliance with vitamin supplements is often low in this age category [11]. A study conducted by Jenkins et al. [12] concluded that compliance with clinical follow-up decreased from 94% in 6 months to 69% in 2 years after bariatric surgery in adolescents [12]. However, data discussing the impact of age on compliance and follow-up rates is still scarce in the literature and more studies are needed to explore this issue.

Psychosocial characteristics and eating behaviors

Morbid obesity is associated with a high prevalence of psychopathological conditions that might have an impact on post-surgery outcomes [13]. Therefore, pre-surgical evaluation of patients undergoing bariatric surgery includes,

among others, a psychological/psychiatric evaluation [14]. Several studies [15–18] have been conducted to assess the impact of psychiatric disorders and eating behaviors on optimal weight loss following the surgery, but very few have discussed their impact on compliance with vitamin supplements and follow-up rates.

Prediction of patients' intentions to comply with post-surgical guidelines has been proposed by Boeka et al. [19], when they tested a psychosocial intervention based on protection motivation theory focused on the importance of adhering to post-surgical eating behavior guidelines and how best to adhere to these guidelines. However, results showed that protection motivation theory intervention didn't have a significant impact in predicting patient's intentions to comply with the guidelines [19].

Adequate pre- and postoperative psychological counseling are suggested to improve the results of surgery [20]. Ironically, some psychiatric disorders like social phobia and avoidant personality disorder seem to influence the willingness to participate in counseling groups. Therefore, individual counseling and/or web-based counseling might be recommended for bariatric surgery patients who are reluctant to participate in group counseling [20].

Although achieving optimal weight loss with minimal complications following the surgery can be related to better compliance and regular follow-up [21], focused studies aiming to identify and manage the impact of psychiatric disorders and eating behaviors on compliance and follow-up rates might need to be considered.

Financial costs and distance from the clinic

Financial costs have always been considered as a major barrier to adequate compliance [11]. Few studies [22–24] were aimed to evaluate patient's satisfaction with shared medical appointments; a relatively new model in patient care that was designed to improve patient's access to their physicians and improve physician productivity. Shared medical appointments demonstrated high levels of patient satisfaction and were cost effective [22,23]. Therefore, such measures can be considered for patients who are financially challenged to enable high volume follow-up rates [24].

Studies that have examined the impact of distance from the clinic on postsurgical follow-up rates have, so far, yielded equivocal results [12,25]. As highlighted by Jenkins et al. [12] distance from the clinic didn't affect follow up rates at 6 months, 1 year and 2 years follow up intervals. However, an earlier study by Lara et al. [25] concluded that distance does tend to affect compliance with clinical follow-up at the 6-month appointment and significantly affects compliance at the 9-month appointment [25]. We believe that using videoconferencing and teleconsultation with patients residing in remote areas might provide a viable and accessible means of delivering care and support [26,27] and might improve follow-up rates in this special population.

Other factors like gender, lower schooling, level of family support and patient's quality of life can also be considered for future investigation to determine their role in compliance and follow up rates.

Suggested strategies for improvement

Preoperative counseling programs and preparatory courses

Getting adapted to the dramatic life style changes after bariatric surgery can be challenging and the effect it has on compliance and follow up rates shouldn't be ignored. Therefore, Knutsen et al. [28] investigated a preparatory course aimed to empower individuals towards lifestyle changes following bariatric surgery. The intention of the study was to provide a basis to question whether these kinds of courses create new forms of compliance and dependency [28]. On the other hand, Lier et al. [29] conducted a study to investigate the role of preoperative counseling programs in improving adherence to treatment guidelines following the surgery, in which they concluded that it is not reasonable to offer a preoperative counseling program for all patients undergoing bariatric surgery; since it didn't increase adherence to recommended treatments [29]. Data regarding the role of preparatory courses and programs in improving compliance and follow up rates is scarce. For this reason, it is recommended to assess such courses in clinical practice [28] and identify patients that are in need for more comprehensive treatment programs [29].

Pharmaceutical consultation services

Bariatric surgery patients often need changes in formulation and dosages of their medications, which can be challenging and can lead to a decrease in compliance rates. Silverman et al. [30] performed 124 consultation services for bariatric surgery patients from February 2, 2009 to December 1, 2010. Their services included patient identification, pharmacy referral, pharmacist consultation with the patient, communication of recommendations with surgeons, follow-up and documentation. They concluded that the collaborative effort between surgeons and pharmacists effected changes in medication transitioning perioperatively and resulted in improved pharmaceutical care for this patient population [30]. Such services might improve patient compliance with medications; however the literature contains minimal information regarding pharmaceutical care and consultation services for the bariatric surgery patient and to our knowledge their effect on compliance rates has not been adequately addressed.

Multidisciplinary team and behavioral support programs

The pre- and postoperative management of bariatric surgery patients is clearly multidisciplinary. US guidelines define the primary team as comprising the bariatric surgeon, the obesity specialist and the dietitian [11]. Primary care physicians, however, have a significant role in managing and following these patients. Having patients assigned to primary care physicians to be followed before and after the surgery would improve compliance by providing crucial patient education and support.

Therapeutic patient education has been proposed in the SOS study [31], which implemented the role of education and behavioral support programs provided to bariatric surgery patients after the surgery in further enhancing the efficacy of bariatric surgery and increasing follow up rates [31]. It is believed that providing education and behavioral

support to these patients prior to surgery as well, will have a significant impact on management and follow up afterwards [11]. Focused research is needed to study the long term benefit of behavioral support programs, when to initiate this particular intervention and to identify which patients will benefit from this type of approach [32].

CONCLUSIONS

Follow-up after bariatric surgery is important for optimal weight loss, improving quality of life and decreasing the risk of nutritional deficiencies [33,34]. Factors influencing compliance and long term follow up have been scarcely studied and little research is present. Moreover, many questions yet to be answered are: Is psychiatric evaluation for all patients prior to surgery going to affect compliance afterwards? What is the role of preparatory courses and are they going to improve outcome? Can a difference be made with the help of pharmaceutical consultation services? Further studies are needed to answer these questions, optimize follow-up and look for modifiable risk factors influencing compliance with vitamin supplements.

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