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THE ROLE OF MICRONUTRIENTS AND VITAMINS IN ANEMIAS DEVELOPING AFTER BARIATRIC SURGERY

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Abstract: This article discusses the importance of micronutrients and vitamins in anemias developing in patients who have undergone bariatric surgery. A total of 35 articles published over the last 5 years in international literature were reviewed and analyzed.

Keywords: anemia, bariatric surgery, mineral elements, vitamins, proteins.

Relevance of the Problem. Over the last decade, global rates of overweight and obesity have risen sharply; as a result, bariatric and metabolic surgeries (such as Roux-en-Y gastric bypass — RYGB, sleeve gastrectomy — SG, biliopancreatic diversion — BPD) have become widely used to treat obesity. Although these operations effectively reduce weight and improve conditions such as diabetes mellitus and hypertension, their long-term metabolic and nutritional complications are emerging as significant medical and social concerns.

In particular, deficiencies of micronutrients (iron, copper, zinc, selenium) and vitamins (B12, folate, D, A, E, K, etc.) are among the most common and clinically significant complications following bariatric surgery. (1)

Obesity has become a growing global health problem. According to the World Health Organization (WHO), in 2022, one in eight people worldwide was living with obesity, and its prevalence among adults has more than doubled since 1990. This negative trend is especially evident among patients with obesity-related comorbidities. Contributing factors include the widespread consumption of highly processed, calorie-dense but nutritionally poor foods, as well as increasingly sedentary lifestyles.

Overweight and obesity are responsible for nearly 5 million annual deaths from noncommunicable diseases such as cardiovascular diseases, type 2 diabetes, cancer, neurological disorders, and chronic respiratory diseases. Bariatric surgery is recognized as an effective and long-term treatment option for obesity, leading to sustained weight loss and improvement or remission of obesity-related conditions. (2)

A retrospective analysis was conducted on the nutritional status of 505 consecutive patients who underwent RYGB or SG between January and December 2019. Data were collected preoperatively and at 6 and 12 months postoperatively, including vitamin B12, folic acid, vitamin D, calcium, PTH, magnesium, hemoglobin, iron, ferritin, and transferrin levels.

The RYGB group demonstrated significantly greater excess weight loss. Levels of vitamin B12, hemoglobin, and ferritin were consistently higher in the SG group throughout the study period. Vitamin D deficiency was widespread, with no significant difference between the two groups. Vitamin B12 deficiency was significantly more common in the RYGB group (at 6 months: 17.46% vs. 4.69%, $p < 0.001$; at 12 months: 16.74% vs. 0.93%, $p < 0.001$). Despite differences in mechanisms, both bariatric procedures were associated with nutritional deficiencies. Therefore,

assessing, preventing, and managing these deficiencies according to each type of surgery is crucial. (3)

Incidence of Anemia and Vitamin Deficiencies After Surgery. According to research findings, the most pronounced difference between patients who underwent RYGB or SG involved postoperative vitamin B12 status. Vitamin B12 deficiency occurred in 17.46% and 16.74% of RYGB patients at 6 and 12 months, respectively, compared with only 4.69% and 0.93% in SG patients. (4).

Study results also showed that vitamin D deficiency was the most prevalent pre- and postoperative nutritional deficiency, occurring in 62.05% of RYGB patients and 74.24% of SG patients. These findings are consistent with previous studies conducted in Mediterranean populations (5).

This high prevalence can be explained by the storage of fat-soluble vitamins in adipose tissue, reduced sun exposure, and low consumption of dairy products. Although deficiency rates declined postoperatively, fluctuations between groups persisted at 6 and 12 months.

In RYGB patients, altered gastrointestinal anatomy may delay mixing of food with bile acids and pancreatic enzymes, thereby reducing absorption of fat-soluble vitamins. The high prevalence of preoperative hypovitaminosis D may partly explain the absence of significant postoperative differences between the groups. (6)

Studies have shown that the prevalence of anemia increases postoperatively in both groups, with no significant difference between the surgical techniques. Although vitamin B12 deficiency may impair erythropoiesis, iron deficiency remains the most common cause of anemia (2,4).

Preoperative chronic inflammation associated with obesity, increased hepcidin production, and inadequate dietary iron intake may contribute to poor iron absorption in these patients, explaining the high rates of iron deficiency. (5,6)

Conclusion. This study demonstrates a high prevalence of nutritional deficiencies in patients undergoing bariatric surgery, with clear associations with specific surgical techniques. Patients who underwent Roux-en-Y gastric bypass (RYGB) showed significantly higher rates of vitamin B12, iron, and folate deficiencies than those in the SG group. These differences may be attributed to postoperative anatomical changes, delayed food mixing in the gastrointestinal tract, and intolerance to certain foods.

Meanwhile, vitamin D deficiency remains the most common deficiency both before and after bariatric surgery, likely due to chronic inflammation associated with obesity, inadequate sun exposure, and low dairy consumption.

Anemia increases postoperatively, with iron deficiency being the leading cause, although vitamin B12 deficiency also affects erythropoiesis. Folate deficiency is relatively uncommon due to its efficient absorption throughout the small intestine. Long-term studies show that RYGB independently increases the risk of vitamin B12 and iron deficiency, whereas SG carries a comparatively lower risk.

These findings highlight the importance of preoperative nutritional assessment, continuous postoperative laboratory monitoring, and personalized vitamin–mineral supplementation tailored to individual needs and the type of surgery performed. Comprehensive, long-term clinical

guidelines based on extended follow-up studies may help prevent and manage postoperative nutritional deficiencies more effectively, ultimately improving long-term health outcomes in bariatric patients.

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