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Original article

Anemia and iron deficiency before and after bariatric surgery

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Abstract

Background: Iron deficiency and anemia are changes often associated with obesity. Bariatric surgery is responsible for increasing the iron loss and reducing its absorption. The objective of this study was to evaluate anemia and iron deficiency before and after bariatric surgery and to relate them to possible predisposing factors.

Methods: A retrospective study was conducted on obese patients submitted to open Roux-en-Y gastric bypass, in which clinical and laboratory data were obtained up to 48 months postoperatively. Patients were divided into groups according to the presence or absence of anemia and to the presence or absence of iron deficiency (even without anemia), and all data were compared between these groups.

Results: Preoperatively, 21.5% of patients had anemia and 20% had iron deficiency. The number of patients with anemia did not vary through the 4 years of the study, but ferritin levels significantly decreased with time ($P < .01$). Younger patients and patients with greater weight loss had a higher incidence of anemia. Female gender was a variable associated with a greater incidence of iron deficiency.

Conclusions: Anemia and iron deficiency are frequent in obese patients and must be treated before surgery. Medical and nutritional surveillance is important in the postoperative period of bariatric surgery. Management of each condition must be directed at correcting the 2 major sources of iron deficiency and anemia: food intolerance (mostly meat intolerance) and losses (frequently due to menstruation). These are the factors more related to iron deficient anemia. (Surg Obes Relat Dis 2014;10:49–54.)

Keywords: Obesity; Bariatric surgery; Anemia; Iron deficiency

Obesity is considered the great pandemic of the third millennium and is responsible for worsening the quality of life and lowering life expectancy [1–3]. Obesity is associated with a chronic inflammatory state [1,4,5].

Anemia caused by iron deficiency has been described in 5.5%–21.9% of obese candidates for bariatric surgery, a higher frequency than observed in the general population (6%–7%) according to data from the World Health Organization (WHO) [6–12]. Many factors are involved in the genesis of this anemia (caused by irregular cycles, nutritional deficiencies), but the aforementioned inflammatory component is an important factor, acting in various stages of the production, transportation, and storage of iron, that will eventually culminate with anemia [13–16]. Iron deficiency, which can occur without anemia, is even more common, with an incidence of 6.9%–45.9% [7,8,11,17–23].

After bariatric surgery, the prevalence of anemia increases significantly over the months (10%–63%) [7,8,11,17–22,24–27]. With respect to iron deficiency, the incidence ranges from 30% to 60%. Several causes justify this deficiency,

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including changes in iron intake and absorption and increase in iron loss in the postoperative period [20–24].

The objective of this study was to evaluate the characteristics of a population of morbidly obese patients, candidates for bariatric surgery in a public teaching hospital, with respect to anemia and iron deficiency during the preoperative period and to determine the incidence of these problems during the first 4 postoperative years, relating them to possible predisposing factors such as gender, age, length of jejunal exclusion, and percentage of weight loss.

Methods

This was a retrospective study of the medical records of all obese patients submitted to bariatric surgery between 2004 and 2007. This study was approved by the ethics committee of our hospital. All patients were >18 years and had a body mass index (BMI) >40 kg/m^2 or >35 kg/m^2 with co-morbidities, in accordance with the minimal requirements for bariatric surgery of the International Federation for the Surgery of Obesity. The surgical technique used was open Roux-en-Y gastric bypass with a 50-cm or a 100-cm biliopancreatic limb and a 100-cm alimentary limb, a 30-mL gastric pouch, and a silastic ring with a circumference of 6.2 cm.

Two weeks after the surgery, all patients started taking an oral multivitamin supplement with 60 mg of iron (ferrous fumarate), to be continued for the rest of their lives.

Clinical and laboratorial data were obtained preoperatively and 12, 24, 36, and 48 months postoperatively. Unfortunately, some patients did not have all the laboratory examinations for all the postoperative periods. The possible predisposing factors analyzed were gender, age, length of jejunal exclusion, albumin levels, and percentage of weight loss.

Patients were initially divided according to the presence or absence of anemia, based on WHO guidelines (hemoglobin [Hb] <13 g/dL in men and <12 g/dL in women for a diagnosis of anemia).

The same patients were divided according to the presence or absence of iron deficiency (even without anemia). For the patient to be classified as having iron deficiency, the following situations were considered: ferritin level <30 ng/mL in the absence of inflammation (C-reactive protein <.5 mg/dL) or a normal ferritin level with low (<20%) transferrin saturation (TSAT), the latter being the ratio of serum iron and total iron binding capacity (TIBC), expressed by the formula:

$$\text{TSAT}\ (\%) = \frac{\text{Serum iron}\ (\text{mg/dL})}{\text{TIBC}\ (\mu\text{g/dL})} \times 100$$

Graph Pad Prism 4 was used for statistical analysis. Continuous variables with normal distribution were compared between groups by the *t* test for unpaired samples and the variables with nonnormal distribution were compared by the nonparametric Mann-Whitney test. The Fisher test was used for the categorical data and the Friedman test was used for comparison of all periods.

Results

The records of 102 patients submitted to Roux-en-Y gastric bypass were evaluated retrospectively. The average age of the patients was 41.9 years, and 85.2% were women. The mean weight and BMI were 132.7 kg and 49.7 kg/m^2, respectively. Before surgery, 21.5% of the patients had anemia and 20% had iron deficiency.

For several reasons, including enteral iron supplementation, nutritional follow-up and interventions, and even anemia treatment, the number of patients with anemia did not vary through the 4 years of the study, but ferritin levels decreased significantly with time ($P < .01$).

By 3 years after surgery, most patients with anemia were younger, and this fact was probably associated with the presence of women of childbearing age having menstruation as an additional source of iron loss. There was no association of anemia with the larger biliopancreatic limb (Table 1).

Thirty-six months after surgery, patients with greater weight loss and lower BMI showed a higher incidence of anemia, coinciding with the observation that these patients also had lower albumin values than the other group. It can be suggested that these patients may have presented greater food intolerance (mainly animal protein), a higher incidence of vomiting, and/or less adherence to the nutritional guidelines. By 48 months, these differences were no longer observed, probably because of nutritional intervention and medication therapy (Table 1).

The incidence of iron deficiency progressively increased during the postoperative period. Female gender was the variable positively associated with this deficiency and with serum albumin, 24 and 36 months after bariatric surgery (Table 2).

Discussion

Iron has a fundamental role in the homeostasis of the organism, participating in many vital cellular processes, such as oxygen transportation, energy production, cell growth, and synthesis of neurotransmitters, among others. Dietary iron is classified as heme iron (animal origin), in its ionic form Fe^{2+} (ferrous), easily absorbed in the duodenum and proximal jejunum, and as nonheme iron, being the form more present in the Western diet. In the latter, the oxidized iron (Fe^{3+}), which is less absorbable, is the form that predominates [1,2,14,28–31].

Transferrin is the protein that transports iron in plasma. Under normal conditions, 20%–50% of the binding sites of iron in transferrin are occupied. Higher values occur in