

INCIDENCE OF VITAMIN B12 DEFICIENCY IN PATIENTS SUBMITTED TO FOBI-CAPELLA ROUX-EN-Y BARIATRIC SURGERY

Incidência da deficiência de vitamina B12 em pacientes submetidos à cirurgia bariátrica pela técnica Fobi-Capella (Y-de-Roux)

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ABSTRACT – Background - Patients undergoing bariatric surgery may develop over time, some complications and anemia is an important one due to gastric resection, leading to iron, folic acid or vitamin B12 deficiency. **Aim** – To determine the incidence of deficiency of vitamin B12 and other anthropometric and biochemical data comparing the preoperative and postoperative (six months) period in patients who underwent bariatric surgery with Fobi-Capella (Roux-en-Y) technique. **Methods** - Retrospective and descriptive analysis of 91 charts of patients who underwent surgery. It was collected personal information, date of surgery and pre- and postoperative (six months) values, weight loss, comorbidities, serum analysis of total cholesterol, triglycerides, glucose, vitamin B12, hemoglobin and hematocrit. For statistical analysis, it was considered significance level of 5% ($p < 0.05$). **Results** - It was found that there was a reduction in weight of 25,0% compared with the preoperative value and the average BMI was from $41,2 \pm 4,9$ kg/m² to $30,7 \pm 3,9$ kg/m². The most common co-morbidities were dyspnea (93,4%), spine alterations (61,5%), gastroesophageal reflux disease (57,1%) and sleep apnea (42,9%). Biochemical tests for cholesterol, triglycerides and blood glucose, presented positive effect, changing from $240,2 \pm 36,1$ to $162,5 \pm 19,1$, $215,7 \pm 78,1$ to $101,0 \pm 21,3$ and $178,7 \pm 55,0$ to $96,8 \pm 15,3$ (mg/dL), respectively. For vitamin B12, hemoglobin and hematocrit, there was no statistical difference in relation to pre and post-operative time; however, was seen a reduction in vitamin B12 in 43 patients (47,2%). **Conclusion** - The deficiency of vitamin B12 after six months of surgery could not be observed; this fact can be attributed to the use of nutritional supplements or to the short follow-up time after surgery.

HEADINGS - Morbid obesity. Bariatric surgery. Deficiency diseases. Vitamin B12 deficiency.

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RESUMO – Racional – Os pacientes submetidos à cirurgia bariátrica podem desenvolver, ao longo do tempo, algumas complicações e a anemia é quadro importante decorrente da ressecção gástrica, levando à deficiência de ferro, ácido fólico ou vitamina B. **Objetivo** - Verificar a incidência da deficiência de vitamina B12 e comparar dados antropométricos e bioquímicos do pré e pós-operatório (seis meses), em pacientes submetidos à cirurgia bariátrica Fobi-Capella (Y de Roux). **Métodos** - Análise retrospectiva e descritiva de 91 prontuários de pacientes submetidos à operação. Foram coletadas informações pessoais, data do procedimento e valores do pré e pós-operatório (seis meses), redução de peso, co-morbidades, colesterol, triglicérides, glicemia, vitamina B12, hemoglobina e hematócrito. Para análise estatística foi utilizado nível de significância de 5% ($p < 0,05$). **Resultados** - Verificou-se que houve redução de peso de 25,0% em relação ao valor pré-operatório e a média do IMC foi de $41,2 \pm 4,89$ Kg/m² para $30,7 \pm 3,98$ Kg/m². As co-morbidades mais encontradas foram dispnéia (93,4%), doenças da coluna (61,5%), doença do refluxo gastroesofágico (57,1%) e apnéia do sono (42,9%). Em relação aos exames bioquímicos de colesterol, triglicérides e glicemia, verificou-se efeito positivo, alterando de $240,2 \pm 36,1$ para $162,5 \pm 19,1$, $215,7 \pm 78,1$ para $101,0 \pm 21,3$ e $178,7 \pm 55,0$ para $96,8 \pm 15,3$ (mg/dL), respectivamente. Quanto à vitamina B12, hemoglobina e hematócrito, não se encontrou nível de significância estatística em relação à deficiência do pré para o pós-operatório, entretanto, pôde-se observar diminuição dos níveis de vitamina B12 em 43 pacientes (47,2%). **Conclusão** - A deficiência de vitamina B12 após seis meses do pós-operatório não pôde ser observada, o que pode ser atribuído ao uso de suplementação ou pouco tempo de seguimento.

DESCRIPTORES - Obesidade mórbida. Cirurgia bariátrica. Deficiências nutricionais. Deficiência de vitamina B12.

INTRODUCTION

Obesity is a chronic, noncontagious, characterized by excessive accumulation of body fat⁸. Is related to increased mortality and monitors multiple complications such as diabetes mellitus, hypertension, dyslipidemia, cardiovascular disease and cancer⁷.

Bariatric surgery as an option for the treatment of obesity is an invasive procedure used to reduce the amount of food that enters or is absorbed in the gastrointestinal tract¹⁶ and its main benefits of weight loss and maintenance, control of associated diseases and consequent improvement quality of life²⁶.

The technique of gastric bypass Fobi-Capella (in Roux-en-Y) has shown better results in 24 months after the procedure^{10,12,24}. Moreover, it is used worldwide and is considered the gold standard¹¹.

Patients undergoing bariatric surgery may develop over time, complications such as anorexia, diarrhea and dumping syndrome. Over time, appear late complications such as, for example, ulcers, osteoporosis, protein-calorie malnutrition, impaired absorption of calcium, iron and vitamins^{19,26}. Besides these, the context is important and anemia due to gastric resection, leading to iron deficiency, folic acid and vitamin B12¹⁹.

Several studies^{3,21,22,25} have shown a high incidence of vitamin B12 in a period of nine years, in patients undergoing this technique.

Given the lack of data at six months postoperatively was considered of interest to study the deficiency of this vitamin and verify the reduction of co-morbidities associated with obesity.

METHODS

The study protocol was approved by the Ethics Committee of the University Paulista UNIP, on 12/06/2008 under No. 064/08. It was approved by the IRB not to use the term informed consent, because it is raising clinical record.

Were analyzed descriptively and retrospectively the charts of adult patients (> 18 years) undergoing bariatric surgery by the technique of Fobi-Capella-Y-Roux, in Concon Clinic, located in the city of Valinhos, SP, Brazil. Data collection was performed in clinic visits made in the postoperative period.

During the medical records were collected variables such as: name, age, sex, medical record number, date of operation, co-morbidities, the values before and six months postoperatively of biochemical tests, including hemoglobin, hematocrit, blood glucose fasting total cholesterol, triglycerides and serum vitamin B12 and still anthropometric data (weight and height), to calculate the body mass index (BMI), to check the nutritional status before and after the operation (Table 1).

The study excluded those patients undergoing other surgical techniques, they did not have at least one biochemical tests designed for this study in pre- and postoperative, postpartum women and patients with some type of mental disorder that could influence the results of this research.

Reference values of biochemical tests, used as a cutoff point, values were below 200 mg / dl for total cholesterol <150 mg / dL for triglycerides \geq 126 mg / dl glucose for characterizing diabetes mellitus and \geq 100 mg / dl and \leq 125 mg / dl for glucose intolerance, and for women <12 g / dl hemoglobin and <37% hematocrit for men and <13 g / dl hemoglobin and <45% hematocrit. For vitamin B 12 is used the value of \leq 250 mg / dl as reference².

For storage of data was performed using the program EpiInfo version 3.5.1. We applied the test McNemar / Stuart-Maxwell to evaluate changes in the postoperative period, according to the parameters analyzed, considering statistical significance level of 5% ($p < 0.05$). In statistical analysis we used the software SAS System for Windows (Statistical Analysis System), version 9.1.3.

RESULTS

The charts of patients who underwent surgery during the period outlined, totaled 133 and 13 were not located and 29 excluded, giving heed to the exclusion criteria. A total of 91 patient charts, and 84.6% women and 15.4% men with mean age 39.0 ± 10.1 years.

Based on the data of weight, it was observed that for the loss was a mean reduction of 25.0% compared to pre-operative period of six months.

Figure 1 represents the evolution of BMI, illustrating the percentage of patients with values ≥ 35 kg / m² and <35 kg / m before and after the operation, in which there is a reduction of excess weight after six months of operation.

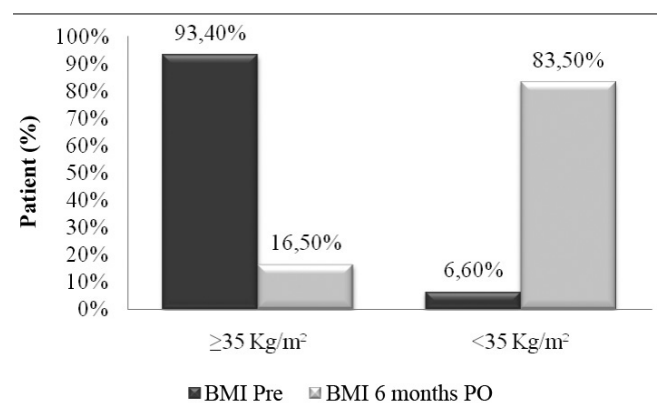


FIGURE 1 - Evolution of body mass index (BMI) of patients before and six months postoperatively (PO)

TABLE 1 - Preoperative reported illnesses associated with morbid obesity

| Comorbidities | N | % |
|---------------------------------|----|------|
| Dyspnea | 85 | 93,4 |
| Diseases of the column | 56 | 61,5 |
| Gastroesophageal reflux disease | 52 | 57,1 |
| Sleep Apnea | 39 | 42,9 |
| Hypertension | 38 | 41,8 |
| Dysmenorrhea | 31 | 34,1 |
| Varicose veins of lower | 27 | 29,7 |
| Depression | 21 | 23,1 |
| Hirsutism | 19 | 20,9 |
| Osteoarthritis in the knees | 17 | 18,7 |
| Hemorrhoidal disease | 16 | 17,6 |
| Diabetes mellitus | 15 | 16,5 |
| Bronchitis / Asthma | 10 | 11 |
| Hypothyroidism | 09 | 9,9 |
| Cholelithiasis | 08 | 8,8 |
| Arrhythmias | 07 | 7,7 |
| Osteoarthritis of the ankles | 06 | 6,6 |
| Sterility | 04 | 4,4 |
| Other | 04 | 4,4 |
| Heart failure | 02 | 2,2 |

In the analysis of the values of weight and BMI pre-and postoperatively, there was an average reduction of 41.2 kg / m² to 30.7 kg / m² in six months. Values concerning weight and body mass index before and six months postoperatively were: 1) weight (kg): preoperative 79.4 to 170.6 (110.7 ± 18.8) and in six months: 59.5 to 142.3 (82.6 ± 15.2), 2) BMI (kg / m²): preoperative 32.2 to 58.3 (41.2 ± 4.89) and in six months : 24.3 to 42.1 (30.7 ± 3.98).

Regarding the lipid profile data in Table 2 can be seen that 40.7% of patients had total cholesterol levels increased in the preoperative period, and these remained changed only 7.7%, down 81, 1% with a significant difference (p <0.0001).

TABLE 2 - Examinations before and six months postoperatively (PO) in relation to lipid profile[§]

| | Preoperative | | Six months postoperative | | p* |
|---------------|--------------|-------------|--------------------------|------------|---------|
| | Amended | Normal | Amended | Normal | |
| Cholesterol | 37 | 54 | 07 | 84 | <0,0001 |
| Mean ± SD | 240,2 ±36,1 | 172,2 ±17,5 | 231,1±16,2 | 162,5±19,1 | |
| Triglycerides | 47 | 44 | 07 | 84 | <0,0001 |
| Mean ± SD | 215,7 ±78,1 | 110,5 ±26,2 | 198,5±45,9 | 101 ±21,3 | |

[§] Expressed in absolute terms (n)
* McNemar test

As the amount of triglycerides in the preoperative period 51.6% of the patients with increased serum levels and remained altered in the postoperative period 7.7%, showing an average reduction of 215.7 mg / dL to 101, 0 mg / dL.

To evaluate the data in hemoglobin and hematocrit was considered possible nutritional deficiency reducing the levels together (Table 4) was observed in the analysis of data showed an increase in the number of patients who presented reduced values six months after the operation in relation the

TABLE 3 - Blood glucose before and six months postoperative (PO)[§]

| | Pré operatório | | | Seis meses PO | | | p [§] |
|---------|----------------|-------------|--------|---------------|-------------|--------|----------------|
| | Diabetes | Intolerance | Normal | Diabetes | Intolerance | Normal | |
| Glucose | 8 | 16 | 67 | 0 | 7 | 84 | <0,0004 |

[§] Expressed in absolute terms (n)
* McNemar test

preoperative period. Table 4 shows population already had anemia in the preoperative period (8.8%).

TABLE 4 - Relationship of patients who had anemia at six months pre-and postoperative (PO)[§]

| | Preoperative | | Six months postoperative | | p* |
|--------|--------------|--------|--------------------------|--------|-------|
| | Amended | Normal | Amended | Normal | |
| Anemia | 83 | 8 | 79 | 12 | 0,285 |

[§] Expressed in absolute terms (n)
* McNemar test

As shown in Table 5, we can see that in the preoperative period were 23.1% of patients with serum vitamin B 12 reduced and it was observed that 76.9% of those with normal levels preoperatively, after six months 15.4% had a below normal values. Seventy three patients with normal levels after six months 14 had disabilities, of which 21 were abnormal preoperatively, 15 were normal postoperatively and six remained unchanged. It is demonstrated decreased serum levels of this vitamin in 43 (47.2%) patients, with mean values of 509.6 ± 330.2 mg / dL in pre rising to 298.2 ± 148.4 mg / dL after six months. The values found were not statistically significant due to the exclusion of the time factor after surgery.

TABELA 5 - Variation of the values of vitamin B12[§] in operated patients

| | Preoperative | | Six months postoperative | | p* |
|-------------|--------------|-------------|--------------------------|-----------|--------|
| | Amended | Normal | Amended | Normal | |
| Vitamin B12 | 21 | 70 | 20 | 71 | 0,8527 |
| Mean ± SD | 190,1± 41,64 | 480,4±309,5 | 193,7±36,7 | 678±663,7 | |

[§] Expressed in absolute terms (n)
* McNemar test

DISCUSSION

With regard to weight loss was a mean reduction of 25.0% compared to pre-operative period of six months. Our results are consistent with the study by Garrido¹³ which evaluated the weight loss of patients who underwent the same surgical technique evaluated in this study, which found an average of 27.0% over this same period. But Valezi²⁹ in their study that analyzed 250 morbidly obese patients who underwent the same operation, observed mean weight loss of 35.0% to 40.0% of preoperative weight after 12 to 24 months. With these data, we notice that the weight reduction is greater in the initial post-surgical, tending

to the loss slower after a few months.

The weight and BMI pre-and postoperatively, had a mean reduction of 41.2 kg / m² to 30.7 kg / m². This result is in agreement with Santos²³ who evaluated 15 patients before and six months after operating them with this technique and achieved a mean reduction of 55.1 kg / m² to 39.7 kg / m².

Comorbidities reported by patients preoperatively were arthropathy, hypertension and diabetes mellitus²⁹. Weight loss following bariatric surgery is accompanied by marked improvement of most co-morbidities related to obesity (diabetes, glucose intolerance, hypertriglyceridemia and hypercholesterolemia).

Regarding the lipid profile data according to the study of White³⁰ was found that in their sample was 73.0% in the pre hypercholesterolemia, and of these, 33.0% returned to normal postoperatively. These data were also found in this study.

As the amount of triglycerides in the preoperative period, 51.6% of patients in this study were increased serum levels, remaining 7.7% change in the postoperative period, showing an average reduction of 215.7 mg / dL for 101.0 mg / dL. According to Carvalho⁶, these levels decreased by 49.2% compared to baseline, reaching an average of 111.4 mg / dL after six months postoperatively.

Obesity has a strong effect on lipoprotein metabolism, and the heavy weight is a determinant of high lipid levels¹⁵. Meta-analysis evaluating the effect of the weight loss on plasma lipid levels in obese subjects with elevated concentrations of lipoproteins indicated that for each pound of weight loss, the total cholesterol decreased by 2.0 mg / dL and TG levels in 0.6 mg / dL, supporting the beneficial effect of weight loss on lipid profile⁹.

Possible explanation for the improvement of blood glucose would be immediate and severe deprivation of nutrients that occurs after surgery⁶. According to Carvalho⁶, who studied 47 obese patients who underwent this operation, where 15 had diabetes and impaired glucose tolerance five. After a year of surgery, 20 patients had normal levels of fasting glucose and glycosylated hemoglobin (Table 3).

Hemoglobin has a fundamental role in the binding of oxygen to the red blood cells in circulation, and hematocrit is the percentage of blood that is occupied by red cells. Low concentrations will indicate anemia that may be manifested by enhanced dietary iron deficiency, but blood loss even in the absence of iron deficiency²⁷. The hemoglobin and hematocrit data were collected to verify the possible deficiency of vitamin B12 which is linked to decreased plasma levels. To evaluate these data was considered as a possible nutritional deficiency to reduce the levels of them together, showing an increase in the number of patients with reduced values six months after the operation compared to preoperatively. In the study

by Santos²³ who analyzed 15 patients after six months, all remained within normal reference values, without a diagnosis of anemia and Rhode²² showed anemia prevalence of 37.0% over a period of 20 months postoperatively, more common among women. In this same study demonstrated iron deficiency in 47.0% of patients. This series already had anemia in the preoperative period by 8.8%¹.

According Paniz¹⁸ tests for diagnosing deficiency of vitamin B12 vary widely with respect to sensitivity and specificity. Thus, many laboratory diagnostic difficulties have been encountered and still not a consensus for a test that was considered the gold standard for diagnosis of this deficiency.

The acidity and peptic hydrolysis help release vitamin linked to food. In the duodenum that binds to intrinsic factor (released by parietal cells). The complex intrinsic factor-vitamin B12 is then absorbed in the ileum. After the operation Fobi-Chapel, more than 30.0% of patients may develop within a deficiency-nine¹⁷. Possible factors contributing to this deficiency include achlorhydria, low intake of B 12 due to intolerance to the main source of food (meat and milk) and reduced secretion of intrinsic factor needed for absorption²⁵.

In this series in the preoperative period, 23.1% of patients were with serum vitamin B12 reduced. It was observed that 76.9% of those with normal levels preoperatively, after six months, 15.4% had a value below the normal range. Nutritional deficit that causes this situation can be explained by the lack of balanced diet in the preoperative period. There is excessive consumption of foods low in nutrients causing nutritional deficiency framework¹.

Brolin³ observed that multivitamin supplementation reduced the incidence of folate deficiency, but did not prevent iron deficiency and vitamin B12. This same study, vitamin B12 in 15.4% of patients after eight months of perform the operation. This reduction usually develops after the first year after surgery, but may also appear before the first six months^{3,5}.

In the literature, the prevalence of vitamin B12 deficiency is estimated to be between 12.0% and 70.0%, and occurs most often after the first year after Fobi-Chapel^{3,22}. Overall, the studies that evaluated 957 patients, the estimated frequency was 25.0% in the first two years¹⁴. The incidence increases later, to about 36.0% to 70.0%⁴. The deficit in the first year less can be explained by this micro-nutrient reserves (2000mg) compared to the daily requirement (2-3mg/day). Some cases of megaloblastic anemia have been reported but are rare. Of the approximately 350 patients, only 0.8% had anemia and macrocytosis without megaloblastic development³.

The daily requirement of vitamin B12 are 2.4 micrograms / day and the amount offered in most multivitamins adult is approximately 6

micrograms. There is an amount suitable for the maintenance of normal operation after⁵. The correction of low levels of vitamin are achieved with the provision 350-500 mcg / day, in its crystalline form administered sublingually or by intramuscular injection of 100 micrograms when orally is not effective^{17,22}. There is no specific recommendation for vitamin B12 but published recommendations suggest supplementation from 500 to 600 mcg / day for multivitamins or 25,000 IU in 20 sublingually.

CONCLUSIONS

A deficiency of vitamin B12 after six months could not be observed, which can be attributed to a short time after surgery evaluated and / or influence of supplementation. The operation has a positive effect on the parameters of cholesterol, triglycerides and glucose levels, but tends to cause significant nutritional deficits that can lead to vitamin B12 in longer term.

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