Al-Azhar Med. J. *Vol. 45(4), October 2016, 825-832*
DOI: 10.12816/0034745

REVIEW ARTTICLE:

NUTRITIONAL COMPLICATIONS OF DIFFERENT TECHNIQUES OF BARIATRIC SURGERY

By

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INTRODUCTION

Obesity is an escalating problem in all age groups and it is observed to be more common in females than males. About 25% of women meet the criteria of obesity and one-third of them are in the reproductive age. Because morbid obesity requiring surgical treatment is observed with increasing frequency, surgeons are undergoing new challenges. **(Snyder-Marlow *et al.*, 2010)**.

Bariatric surgery is widely accepted as first choice treatment of morbid obesity. The number of operations each year is increasing, as well as, consequently, the urgent need for a coordinated nutritional approach, as protein deficiencies, vitamins deficiencies, micronutrient deficiencies occur frequently in these patients. Official guidelines on chronic use of multivitamins and minerals are, yet, unavailable in bariatric medicine. The current review provides an algorithm that supports bariatric teams to guarantee adequate nutrition after the operation. **(Snyder-Marlow *et al.*, 2010)**.

Obesity is a multi factorial disease in which the excess of body fat is related to genetic predisposition and mainly environmental factors. Patients with severe obesity often suffer serious illness as well as physical and psychological disabilities that markedly increase mortality and morbidity. Certainly, the first-choice therapy for severe obesity is a non surgical program that integrates behavior modifications, adequate physical activity and psychological support. **(Snyder- Marlow *et al.*, 2010)**.

However, in many cases of severe obesity, non surgical treatment fails in providing sustained weight loss and surgical treatment can be indicated in some specific cases (body mass index 40 or 35 with co-morbidities). Although bariatric surgery was first introduced in the 1950s, safe and successful surgical management has progressed over the last two decades, Bariatric surgeries are divided into restrictive, restrictive mal-absorptive and mal-absorptive procedures. Several recent reviews about open and laparoscopic procedures have been published **(Snyder-Marlow *et al.*, 2010)**.

Purely restrictive procedures, including vertical banded gastro-plasties and silastic ring vertical gastro-plasties, are based on the reduction of gastric capacity, reducing food intake. The weight loss in these techniques is moderate, in general less than that established as the criteria of success (excess-weight loss 45% sustained for at least 5 years after surgery) **(Smith *et al.,* 2011).**

The classical restrictive mal-absorptive surgery is the Roux-en-Y gastric by-pass (RYGB). In this procedure, gastric capacity is reduced by 90–95%. The bilio-pancreatic limb is ana-stomosed generally 50–100 cm above the ileo-cecal valve, creating the common limb. As food and enzymes are only mixed in the small area of the common limb, the digestion and absorption of most nutrients are compromised **(Smith *et al.,* 2011).**

The first mal-absorptive operation was the jejuno-ileal by pass. Due to severe nutritional complications, this procedure is now discredited. Bilio-pancreatic diversion with or without duodenal switch replaced jejuno-ileal by pass. Bilio-pancreatic diversion consists of a modest gastric restriction associated with a long bilio-pancreatic limb with the common limb of 50 cm. In bilio - pancreatic diversion with duodenal switch, there is a smaller gastric pouch with preservation of the pylorus and a small portion of duodenum. As a consequence of these mal-absorptive procedures, an excess-weight loss of 75–80% can be reached. (**Snyder-Marlow *et al* ., 2010)**.

However, it was found a reduction of fetal macrosomia and normalization of the infant's birth weight in pregnant women previously submitted to bilio-pancreatic diversion. Despite favorable pregnancy outcomes after bariatric surgery, careful studies are required to evaluate nutritional status in both mother and child after bariatric surgery in mothers **(Maggard *et al*., 2008)**.

Many obese subjects already have clinical or subclinical nutritional deficiencies before surgery, such as of vitamin D, folate , and vitamin B12. Bariatric surgery can also result in nutritional deficiencies, the most common deficiencies reported are B12 (12-33%), iron (49-52%), and vitamin A (50-70%) with B12 and iron more prevalent in Rou–en-Y -GB and vitamin A more prevalent in BPD-DS. BPD-DS also carries greater risk of developing vitamin K, Zinc, and vitamin D deficiencies **(Barnett 2007).**

The BPD-DS patient had a greater risk of developing folate (37.%), vitamin D (100%), and transferring (83%) deficiency. The Rou–en-Y -GB patients had a greater risk of developing anemia (50%) ***(*Thampi *et* a*l* ., 2007)**

The most common nutrient deficiencies among all surgery types were iron (34%), vitamin D (66%), vitamin A (35%), and albumin (38%), Comparing the rate of nutrient deficiencies among restrictive and mal-absorptive surgeries there were greater risks of developing nutrient deficiencies following mal-absorptive procedures **(Brolin *and Kowalski* 2007)**.

Morbid obesity and associated health problems have increased at un-precedented rates over the past two decades. To date traditional methods of weight loss including diet modification, exercise, behavioral therapy, and pharma-cotherapy remain ineffective at rates of

2.1 - 10 % EBWL over 2 years with continued behavioral intervention (**Bavaresco *et al*., 2012).**

Recently, it has even been suggested that one-third to two-thirds of dieters regained more weight than originally lost on their diets and that regardless of the amount of weight lost improvements in health were not consistently observed **(Bavaresco *et al* ., 2012).**

However, the success of bariatric surgery in generating long-term weight loss and reducing co-morbidities is well documented **(Skroubis *et al*., 2006).**

The following improvements have been noted following RYGB surgery: 64 - 100% resolution of diabetes, 25 - 100% show resolution of hypertension, 60 - 100% show resolution of dys-lipidemia , 74-98% resolution of obstructive sleep apnea, 72-98% resolution of gastro-esophageal reflux disease, and an 89% reduction in 5 year death rate **(Agha-Mohammadi and Hurwitz 2008)**.

Weight loss percents have been reported at 61.6% for RYGB, 47.5% for LAGB over a 2-year period and 73 – 80% for BPD-DS over a 9-month to 10-year period. Our weight loss findings were on par with this as we found 59.7% for RNY-GB, 46.3% for VSG (purely restrictive procedure similar to LAGB), and 70.9% for BPD-DS after 1-year.The downside is that bariatric surgery can also result in nutritional deficiencies and complications related to surgery. However, the risk of developing deficiencies and complications following bariatric surgery remain poorly studied, as do specific nutrient recommen-dations to prevent deficiencies. ***(*Aills *et al., 2008)***.

The most common deficiencies reported are B12 (12-33%), iron (49-52%), and vitamin A (50-70%) with B12 and iron more prevalent in RNY-GB and vitamin A more prevalent in BPD-DS. BPD-DS also carries greater risk of developing vitamin K, Zinc, and vitamin D deficiencies **(Barnett *et al*., 2007).**

The BPD-DS patients in our essay had a greater risk of developing folate (37.%), vitamin D (100%), and transferrin (83%) deficiency. However, the small sample size (n=8) of the BPD-DS group must be taken into account when interpreting these results **(Decker *et al* ., 2007*).***

The RNY-GB patients had a greater risk of developing anemia (50%),The most common nutrient deficiencies among all surgery types were iron (34%), vitamin D (66%), vitamin A (35%), and albumin (38%). There were too few vitamin E, vitamin K, and zinc values overall to produce good results or an accurate comparison among surgeries. It was found that B12 deficiency occurred in only 1.2% of patients within the 3-18 month time frame following surgery. Up to 36% of vitamin B12 deficiency has been observed in other studies **(Agha- Mohammadi *and* Hurwitz, 2008)**.

Our low incidence may be related to the multivitamin that was recommended, which at its maximum dose gave 500 mcg of vitamin B12 daily and was to be started one week following surgery and continued long term. It was also found that the vitamin B12 deficiency occurred following the VSG and 4% of VSG patients had an occurrence of folate deficiency, where in previous studies no vitamin B12 or folate deficiencies

occurred following restrictive procedures ***(Koffman et al., 2006).***

Comparing the rate of nutrient deficiencies among restrictive and mal-absorptive surgeries remains under-evaluated and the traditional rule of thought was that there were greater risks of developing nutrient deficiencies following mal-absorptive procedures. In our research we found that there were surprisingly few differences in deficiencies between the RYGB and the VSG. The only significant finding was that the RYGB patients had a greater risk of developing anemia following surgery. It was also notable that there was such a high overall rate of fat soluble vitamins, even among of the restrictive VSG (20% vitamin A deficiency and 63% vitamin D), as this has not been documented in previous findings **(Shankar P *et al.*, 2010).**

In addition to this, we found that the average vitamin D level after surgery among all surgery groups was below the normal reference range. The 66% deficiency rate of vitamin D was much higher than the 25.7%seen in previous studies **(Barnett, 2007).**

Our finding also support previous researches about the risk of calcium deficiency in purely restrictive versus mal-absorptive procedures .We also found an absence of documented calcium deficiencies in the VSG group within the 3 - 18 months following surgery while there were documented calcium deficiencies in both the RNY-GB and the BPD-DS groups **(Shankar P *et al.*, 2010).**

Some studies have suggested that the laparoscopic adjustable gastric banding (LAGB) or sleeve gastr-ectomy are more suitable for young women than Roux-en-Y gastric bypass or Bilio-pancreatic Diversion **(Bal *et al* ., 2012).**

After mal-absorptive bariatric surgery all pregnant patients should be precisely examined with supplementation and if necessary supplemented (**Kjaer and *Nilas*., 2012).**

Patients have to be informed about avoiding pregnancy in the first year after bariatric surgery and about the insufficiency of oral contraception **(Bebber *et al*., 2011).**

The period of pregnancy and breast feeding should be correlated with the laboratory tests' controls in each trimester and later every three months with the adequate supplement modification. Currently there are no recommendations for pregnant women following bariatric surgery, Folate and vitamin B12 deficiencies in the peri conceptional period contribute to neural tube defects, and low serum levels of B12 have been linked to negative cognitive, motor and growth out comes , which commonly involve the central and peripheral nervous system **(Thampi *et al*., 2007).**

The American College of Obstetrics and Gynecology recommends that women who have undergone bariatric surgery receive nutritional counseling before and after conception**.**

CONCLUSION

Most publications about bariatric surgery state that the analysis of excess-weight loss and improvement of metabolic complications are the major goals of this

type of surgery. However, the success of surgical treatment of morbid obesity needs to include not only weight loss and the improvement in Nutrition and the gastrointestinal tract obesity-related co-morbidities, but also changes in quality of life experienced by the patients after the operation. In addition, a careful and regular check of nutrients should be also introduced once their deficiencies limit quality of life. As both success of surgery and incidence of nutritional deficiencies are related to the magnitude of weight loss, especial attention should be given to patients undergoing more aggressive mal-absorptive procedures. Adolescents and women in reproductive age are the most vulnerable groups at risk of nutritional deficiencies. To avoid severe nutritional deficiencies as seen in the first years after bariatric surgery it is important to predict, prevent, and promptly treat nutritional abnormalities in vulnerable patients.

RECOMMENDATIONS

We recommend for bariatric patients:

1. Drawing of vitamin and mineral levels pre-operatively to identify and correct nutritional deficiencies prior to bariatric surgery. Within this study, vitamin D, MCV, hemoglobin or hematocrit, albumin, and vitamin A were the lab values most frequently abnormal prior to surgery.
2. Routine testing following bariatric surgery should be performed even for patients receiving purely restrictive procedures.
3. Long-term data needs to be evaluated to better determine risks and benefits of the VSG.
4. Consideration to draw nutritional labs should be given to any morbidly obese patient.
5. Registered dietitian visits before and after surgery show benefits in both weight loss and nutritional status and should be considered as part of a comprehensive bariatric program.

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دراسة المضاعفات الغذائية الناتجة عن التقنيات المختلفة من جراحات علاج البدانة

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تعد السمنة المفرطة مرض العصر الحديث حيث زادت معدلات السمنة المفرطة المصحوبة بمشاكل صحية عديدة بمعدلات غير مسبوقة خلال العقدين الماضيين. ولا تزال الطرق التقليدية فى فقدان الوزن غير فعالة فكثيرا ما يستعيد المريض الوزن الذى فقده بالطرق التقليدية بل وقد يزداد وزنه عن الماضى بخلاف العلاج الجراحى الذى يؤدى الى فقدان مستمر للوزن مع الحد من الامراض المصاحبة. على سبيل المثال بعد اجراء عملية تحويل للمسار المعدى فقد وجد تحسن فى مرض السكرى بنسبة 100% وارتفاع ضغط الدم بنسبة من 25-100% ومن مرض توقف التنفس بنسبة 72-98% ويساعد هذا النوع من العمليات ايضا على الحد من معدل الوفيات الجانب السلبي هو أن جراحة علاج البدانة يمكن أن يؤدي أيضا إلى نقص التغذية ومضاعفات الجراحة. ومع ذلك، فإن خطر الإصابة بهذه المضاعفات وأوجه القصور والمضاعفات بعد الجراحة لعلاج البدانة لا تزال تدرس على نحو سيء. ويعد نقص الفيتامينات والعناصر الغذائية والأملاح المعدنية بالجسم هى أهم العيوب المصاحبة لعمليات جراحة البدانة، على سبيل المثال نقص فيتامين ب12 بنسبة 12-33%،فيتامين أ بنسبة 50-70% ، فيتامين د بنسبة تصل إلى 100% ،وتختلف هذه النسب من عملية الى عملية أخرى . ولابد من ألأخذ بعين الاعتبار النساء اللاتى خضعن لهذا النوع من العمليات بحيث تكون على علم بضرورة تجنب الحمل خلال السنة ألأولى بعد اجراء العملية مع ضرورة إجراء الفحوصات الدوريه أثناء الحمل والرضاعة ، حيث يتسبب نقص فيتامين ب12 ، حمض الفوليك فى عيوب خطيرة فى ألأنبوب العصبى للجنين التى تؤثر على النمو الحركى والسلوكى للطفل . وكان الهدف من هذا الاستعراض تلخيص المعرفة الحالية حول أوجه القصور فى التغذية عقب الخضوع لجراحة علاج البدانة، من نقص المغذيات الدقيقة بعد علاج البدانة بالطرق الجراحية فوجود الحد الأدنى من المعلومات بشأن نسبة المغذيات الدقيقة بعد علاج البدانة بالعمليات الجراحية.هام حيث أن المغذيات الدقيقة هي عوامل أساسية مطلوبة للإنسان بنسب ضئيلة تقدر بالميكروجرام أو المليغرام، لتداخلها في مختلف المسارات الأيضية .وتشمل المغذيات الدقيقة العناصر النادرة (مثل الكروم والسيلينيوم، الزنك)، الفيتامينات القابلة للذوبان في الماء (مثل الثيامين فيتامينب1، فيتامين ب6، النياسين، وحامض الفوليك، ، البيوتين، فيتامينب12،فيتامين جيم، الخ)، والفيتامينات القابلة للذوبان في الدهون (فيتامين أ، د، هـ، ك) والمعادن الأساسية بما في ذلك الحديد والكالسيوم واليود.

فنقص الفيتامينات والمعادن شائع بعد جراحات علاج البدانة، وكثير من متخصصى علاج البدانة يوصون بأخذ هذه الفيتامينات والمعادن، وكذلك مكملات الكالسيوم يوميا بعد الجراحة. وترتبط هذه العيوب معا بإنخفاض في الإستهلاك الغذائي، ومع التأثير الفسيولوجي الناجم عن التغييرات التشريحية التي أجريت في الجهاز الهضمي من المهم أن نلاحظ أن بعض مرضى نقص العناصر الغذائية موجود بالفعل قبل الجراحة (كنتيجة ثانوية لمختلف الإضطرابات الهضمية). كما أن نقص فيتامين ب12 قد يؤدي إلى فقر الدم ، قلة الصفائح والكريات البيضاء، والتهاب اللسان، وكل هذه ألأعراض قابلة للعلاج بالمكملات الغذائية ونقص الحديد أيضا هو واحد من أهم أوجه قصور التغذية الأكثر شيوعا بعد جراحة السمنة لأسباب متعددة كسوء الإمتصاص وسوء الهضم.كما تشير الدراسات أيضا الى قصور فى فيتامينات أ ،هـ مما يمكن أن يسبب جفاف الملتحمة وعشى ليلى، مع تدهور بصري وقد لوحظ أيضا نقص حمض الأسكوربيك أو فيتامينسى بعد الجراحة لانخفاض كمية الفواكه والخضروات المتناولة ، وعدم تناول مكملات فيتامين سى . وقد يحدث عجز في الطاقة بسبب الإستهلاك الغذائي المنخفض وسوء الأمتصاص .ويتجلى هذا النقص كما فى نقص البروتين وإنخفاض امتصاص الكربوهيدرات الغذائية نتيجة لسطح الامتصاص المحدود وانخفاض في إفراز إنزيم البنكرياس وتفاعل محدود بين السكريات والأميليز ويظهر ذلك فى صورة إجهاد ، وفقدان قوة العضلات وفقدان الوزن .