Assessment of vitamins D and B12 after laparoscopic sleeve gastrectomy

Rula M. Abdual-Hafed[1] Issam Merdan[2], Abdul Kareem G. Alebadi[3]

ABSTRACT

Background: **Obesity is a big health problem due to its related diseases, so laparoscopic sleeve gastrectomy is one of the bariatric surgeries which have a role in the weight reduction, but it affects the micronutrients concentrations including vitamins D and B12.**

Aims: **To assess concentrations of vitamins D and B12 prior to laparoscopic sleeve gastrectomy and post-surgery in first, third, sixth and twelve months after the surgery by taking blood samples in this scheduled follow up visits.**

Patients and Methods: **This study was carried out in department of surgery at Al-Sadr Teaching Hospital in Basrah, Iraq from June 2016 to June 2017.It include 82 patients from both gender and from different age groups. Detection of Vitamins D and B12 deficiency pre and postoperative periods, in every follow up visits were by taking a samples of blood and statistical calculation of vitamins values.**

Results: **There were no significant differences related to the age groups but there were a significant reduction of both vitamins in relation to sex and time (pre and postoperatively). The deficiency of vitamin D before surgery mean (35.18) which decreased then increased reaching (37.46) in the end of first year post surgery which was a significant P value 0.045, while the deficiency of vitamin B12 prior to surgery which was 51.90 then after surgery decreased then increased reaching 51.58 by the end of first year post surgery which was non-significant P-value 0.490 (P value < 0.05 significant).**

Conclusions: **This study determined the presence of deficiencies of both vitamins D and B12 before and after laparoscopic sleeve gastrectomy during first year post surgery, so it is recommended for giving vitamin D prior to surgery, while vitamin B12 was not given.**

Keywords: vitamin D, vitamin B12, sleeve gastrectomy, assessment

تقييم الفيتامينات D و B12 بعد استئصال المعدة بالمنظار

الخلفية: تعتبر السمنة مشكلة صحية كبيرة بسبب الأمراض المرتبطة بها ، لذا فإن استئصال المعدة عن طريق المنظار الجراحي هو واحد من جراحات علاج البدانة التي لها دور في تقليل الوزن، ولكنها تؤثر على تركيزات المغذيات الدقيقة بما في ذلك الفيتامينات D و B12.

الأهداف: لتقييم تركيزات الفيتامينات D و B12 قبل استئصال المعدة والأعصاب بعد الجراحة بالمنظار في الأول والثالث والسادس واثني عشر شهرا بعد الجراحة عن طريق أخذ عينات من الدم في هذه الزيارات المتابعة المقررة.

المرضى والطرق: أجريت هذه الدراسة في قسم الجراحة في مستشفى الصدر التعليمي في البصرة ، العراق من يونيو ٢٠١٦ إلى يونيو ٢٠١٧. وتشمل ٨٢ مريضا من الجنسين ومن مختلف الفئات العمرية. الكشف عن نقص الفيتامينات D و B12 قبل وفتر ما بعد الجراحة، في كل مرة متابعة كانت عن طريق أخذ عينات من الدم والحساب الإحصائي لقيم الفيتامينات.

النتائج: لم تكن هناك اختلافات كبيرة تتعلق بالفئات العمرية ولكن كان هناك انخفاض كبير في كل من الفيتامينات فيما يتعلق بالجنس والوقت (قبل وبعد العمل الجراحي). نقص فيتامين (D) قبل الجراحة يعني (٣٥.١٨) الذي انخفض ثم زاد (٣٧.٤٦) في نهاية السنة الأولى بعد الجراحة والتي كانت قيمة P كبيرة ٠.٠٤٥، في حين أن نقص فيتامين B12 قبل الجراحة الذي كان ٥١.٩٠ ثم بعد انخفضت الجراحة ثم زادت لتصل إلى ٥١.٥٨ بنهاية السنة الأولى بعد الجراحة والتي كانت قيمة P غير كبيرة ٠.٤٩٠ (P <0.05 قيمة كبيرة).

الاستنتاجات: حددت هذه الدراسة وجود أوجه القصور في كل من الفيتامينات D و B12 قبل وبعد استئصال المعدة الأكمام بالمنظار خلال الجراحة بعد السنة الأولى، لذلك فمن المستحسن إعطاء فيتامين (د) قبل الجراحة ، في حين لم يعط فيتامين B12.

الكلمات المفتاحية: فيتامين D، فيتامين B12، تكميم المعدة، تقييم

[1]MBCHB, Al-Sadr Teaching Hospital

[2]FICMS, CABS, Consultant Surgeon, Professor of Surgery, Department of Surgery, Basrah Medical Collage.

[3]CABS, FACS, Consultant Surgeon, Al-Sadr Teaching Hospital

INTRODUCTION

In last decades, obesity had become a big health problem. Approximately 1.7 billion people are overweight, and 312 million are obese.[1] Obesity is defined as a body mass index (BMI) above 30 kg/m2, it is related to multiple diseases such as coronary heart disease, hypertension, insulin resistance type 2 diabetes, hyperlipidemia, obstructive sleep apnea, muscular and joint pain, degenerative osteoarthritis, and depression.[2] laparoscopic sleeve gastrectomy (LGS) is one of bariatric surgery to overcome obesity. The mechanism of action after LSG and the physiological impact of gastric volume restriction, alteration in gastric tube's gradient and pressure, hormone effect on, gastric motility and gastric emptying all these factors have important effect on vitamins absorption especially vitamin B12 and D.[3] Many of bariatric surgeries frequently causes different types of nutritional and metabolic complications.[4] There are a lot of reports on outcome of LSG regarding body composition, protein status, and nutrient deficiencies before surgery[5] The normal sequence of events that lead to absorption of protein bound vit B12 begins with release of vit B12 from food by hydrochloric acid and pepsin in stomach, the free vit B12 attached to R-binder protein from saliva and stomach juice and pancreatic enzymes in the upper small intestine. The vit. B12 then transferred to intrinsic factors to form a complex that usually remains intact until it adheres to specific receptors in distal ileum in anticipation of absorption.[6] Vit. B12 deficiency after 1 year post LSG was detected in > 25% of severely obese patients.[7] Most of vitamin D (VitD) made in form of vitamin D3 (VitD3), which needs exposure to ultraviolet beam rays and hydroxylation done in the liver and kidneys to reach its active form as 1,25-dihydroxyvitamin D3. Vitamin D2 and a small amount of VitD3 are found in dietary sources. Vit. D reach through most tissues in the body via its nuclear or membrane receptors.[8] Vit. D insufficiency is common in obese individuals and bariatric patients, and often requires substantial supplementation to achieve sufficiency. Vit.D insufficiency (< 50 mmol/L) affects 31.6-92% of morbidly obese individuals prior to LSG. Bariatric surgery is associated with decreased bone mass and increased fracture risk, highlighting the importance of Vit.D in this population.[9] Additionally, Vit.D deficiency and morbid obesity have been linked to many of the same comorbidities. The current guidelines for nutritional care of bariatric patients recommend Vit.D supplementation of at least 3000 IU/day for LSG patients during early post-operative care until serum 1, 25-hydroxyvitamin D3 levels reach > 70 mmol/l, with no need for on-going monitoring of vit.D status.[11]

The aim of this study is to detect vitamins D and B12 deficiencies prior to LSG and during the first year postoperatively in a scheduled follow up.

PATIENTS AND METHODS

This is a prospective randomized study to assess Vit.D&B12 pre and post laparoscopic sleeve gastrectomy on 82 patients from both genders was done at Al-Sadr Teaching Hospital in Basrah, Iraq from June 2016 to June 2017. After exclusion of patients who had comorbidities and those who were on supplementations. Multiple teams have performed a combined medical, nutritional, and surgical work-up to evaluate potential surgical candidates. Preoperative assessment included details dietary history and interview with a dietician and patients had many investigations 1 to 3 days prior to surgery including abdominal ultrasound, upper oesphagogastroduodenoscopy for symptomatic patients, electrocardiogram, chest x ray, and blood investigations in form of complete blood count, renal function test, blood sugar, thyroid function test and serum vit.D&B12 levels. At the day of surgery and overnight fasting,

patients were admitted to theater. Under general anesthesia and supine trendelenburg's position, 4 ports were inserted in the abdominal wall, surgery was done and results in narrow gastric tube as shown in (Figure-1). After surgery the patients stayed for 3 to 4 days postoperative in the ward for treatment and nursing care.

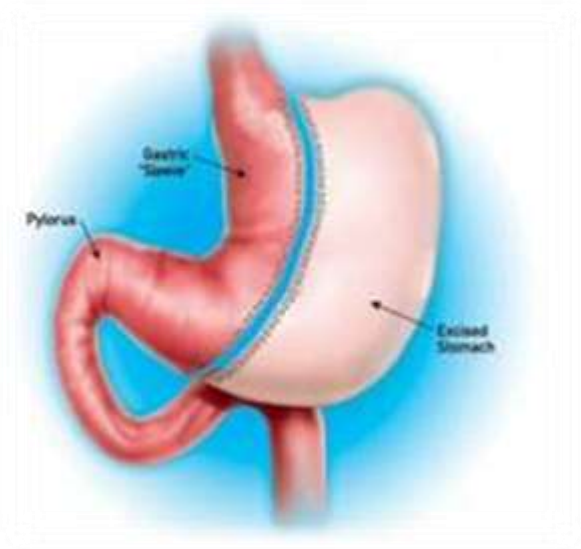

Fig 1. Laparoscopic Sleeve Gastrectomy

The patients were advised to scheduled postoperative follow-up in a 1,3,6 and 12 months post-surgery, for every visit they had anthropometric measurements and biomaterial sampling. All the 82 patients were attended in the scheduled visits and in each visit The Serum level for vitamin D and B12, were assessed by a competitive immunoassay technology.

Deficiencies were defined as a serum concentration below the reference interval:

1. **Vitamin D (50-170mmol/L).**
2. **Vitamin B12 (20–90 ng/dl).**

The effect of the dietary supplements used on deficiencies was analyzed by chi-square test. P-value < 0.05 was considered as a significant result and all analyses were carried out by using the statistics software SPSS (statistical package for the social sciences, version: 25).

RESULTS

The characteristics of the patients included in the study were shown in (Table-1), there were 21 males and 61 females patients. The range of age is between 35 to 45 years old

Table 1. Age gender distribution.

Parameters	*No. of patients N=82*	*%*
Males	**21**	**26**
Females	**61**	**74**
Age	**35-45 yrs.**	**44 ± 9 mean**

The body mass index ranged from 44 to 58 kg/m^2.as shown in (Table-2)

Table 2. Body mass index of the patients.

Parameters	*No. of patients N=82*	*%*
Males	**21**	**26**
Females	**61**	**74**
BMI	**44-58 kg/m^2**	**51 ±5 mean**

This study revealed that there was deficiency of both vitamins prior to surgery in both sexes which observed accidently during preoperative investigations. Regarding vit.D, there was 68 patients had deficiency which represent 83% and the mean level was 35.18, while the other 14 patients revealed normal concentration of vit.D represents 17% and also there were deferent values according to sex as shown in (Table-2,3).

Table 3. Mean & SD values of vit.D for both sex.

Time		Male	Female	P value
Preop		41.5 +/-15.8	33.0+/13.3	0.018
Post Op.	*1st mon.*	39.0+/-15.6	30.8+/-13.3	0.023
	3rd mon.	37.3+/-14.8	29.0+/-13.1	0.021
	6^{th} mon.	39.3+/-14.7	31.7+/-12.7	0.026
	12^{th} mon.	43.0+/-14.6	35.8+/-12.9	0.034

The mean of vitamin D values was significantly higher among males as a compared with females at preoperative period and subsequent months postoperatively. In general during the first follow-up visit after 1 month, there was a significant reduction in the concentration of vit.D which was proved by calculation of the mean which was (32.90) and more decrease in the second follow-up visit at 3rd month (31.01), then there was an increase of the mean in the third visit after 6 months (33.63) and more increase by the end of first year post operatively (37.40) and P value was (0.045) which is significant as demonstrated in (Table-3 and Figure-2).

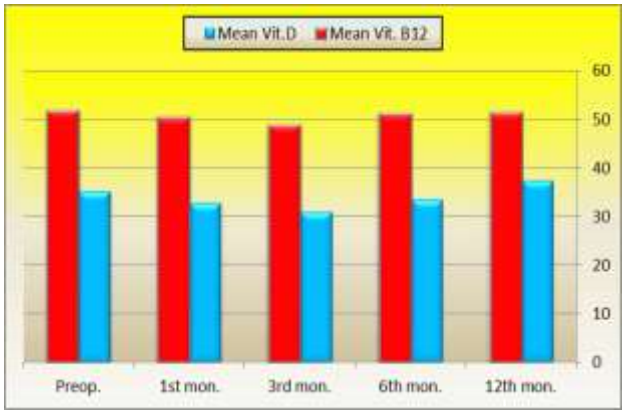

Fig 2. Mean values of vitamins D&B12.

On the other hand, there was also reduction in the concentration of vit.B12 prior to surgery in 8 patients only, which represent 9.3% and the mean level was (51.90) while the other 74 patients showed normal concentration level (90.7%) and there was differences between both sex as shown in (Table - 4,5).

Table 4. Mean values of vit.D of both sexes with SD.

Time		Mean+/-SD
Preop.		35.18+/-14.35
Post Op.	*1st mon.*	32.90+/-14.32
	3rd mon.	31.01+/-13.93
	6th mon.	33.63+/-13.59
	12th mon.	37.46+/-13.09

P value=0.045

Table 5. Mean & SD values of vitamin B12 in both sex.

Time		Male	Female	P Value
Preop.		47.05+/-23.67	53.57+/-22.64	0.263
Post Op.	*1st mon.*	45.57+/-23.88	52.39+/-22.56	0.242
	3rd mon.	43.86+/-23.82	50.61+/-22.72	0.250
	6th mon.	46.10+/-23.83	52.98+/-22.41	0.235
	12th mon.	50.34+/-23.85	56.97+/-21.96	0.240

The mean values of vit.B12 were decreased in both males and females prior to surgery and subsequent follow up months postoperatively but this reduction was statistically not significant which is obvious by calculation of mean and p values for all patients collectively as shown in (Table-6 and Figure 2)

Table 6. Mean & SD of vit.B12 of both sexes.

Time		Mean & SD
Preop.		51.90+/-22.94
Post Op.	*1st mon.*	50.65+/-22.94
	3rd mon.	48.88+/-23.83
	6th mon.	51,22+/-22.50
	12th mon.	51.58+/-22.84

P-value 0.490

The above table showed that during the first follow up visit at 1st month post-operatively, there was a significant reduction in thevit.B12 level in which the mean calculation was (50.65) and more reduction in the 3rd month (48.88) then there was increase in the 6th month (51.22) and more increase by the end of the first year post operatively which was (51.58) and p value was (0.490) which is of not statistically significant.

DISCUSSION

According to the results of both vitamins concentration and statistical analysis, there was obvious deficiency in the concentrations of vitamin D prior to surgery in 68 patients out of 82. Because of fat soluble properties of vit. D and it's potential action in the subcutaneous fat of obese patients, therefore most of the obese patients had vit.D deficiency before surgery.[8] On the other hand deficiency of vit.B12 was far less percentage in obese patients before surgery in 8 patients out of 82 due to it's wide spread in the dietary food but deficiency occur due to diseased stomach and the storage of this vitamin last for 2 to 3 years prior to deficiency and if the patients were already strict vegetarians who avoid meat, egg and milk which are rich in vit.B12. As a consequence of lack of parietal cells of the stomach after laparoscopic sleeve gastrectomy, there was a decrease in the absorption of both vitamins because of deficiency of intrinsic factors which is important in biochemical mechanism of absorption. Also because of decrease of stomach size after surgery so there would be a decrease in food intake and this is effective for weight reduction but worsen multivitamins absorptions including vitamins D and B12. During the first follow-up visit after first month, there was a reduction in vit.D in both who had previous deficiency and those who had not, which mean that the deficiency occur in any way not dependent on the vitamin concentration in preoperative period and more decrease in the later months so, according to the protocol of this study, we advise to give the patients who had the deficiency vit.D a supplements in form vit.D capsule 5000IU daily and those who had sever deficiency gives vit.D capsule 50000IU weekly till reaching a normal level of serum concentration. This would cover daily requirement of the vitamin and improve serum concentration level of the vitamin especially after sixth month in postoperative period and more improvement by the end of first year postoperatively. This study is similar to other study which done in Germany, university of Hohenheim at 12 march 2012 and the results was similar to the results of that study regarding the pre and postoperative period.[4] Regarding vit.B12 there was a mild reduction in serum concentration that was detected in the first visit at first month for both who had previous deficiency and those who had not, but this reduction statistically not significant(P value > 0.05) and continue mild deficiency at the third month in a slow manner so the supplements were advised to those patients in form of vit.B12 1000mcg ampoules daily for 7to 10 days and in addition weakly same dose for one month then monthly for those patients with severe deficiency till reaching normal serum level of vit.B12, this would controls the deficiency and explain the increase in the vitamin concentrations after sixth month and more increase by the end of first year postoperatively.

CONCLUSION AND RECOMMENDATION

This study demonstrated the presence of a significant deficiency of Vit.D before and after LSG during first year post surgery and there was not significant deficiency regarding Vit.B12. This study recommend that giving the supplementations of vitamin D for those patients who plans to do LSG prior to surgery will make the deficiency of the vitamin less during the first year post surgery and less burden upon the patients and less complications.

REFERENCES

1. **Pech N, Meyer F, Lippert H, Manger T, & Stroh, C. (2012). Complications and nutrient deficiencies two years after sleeve gastrectomy. BMC surgery, 12(1), 13. Volume 2012, Article ID 828737, 9 pages doi:10.1155/2012/828737.**

2. Capoccia D, Coccia F, Paradiso F, Abbatini F, Casella G, Basso N, & Leonetti F. (2012). Laparoscopic gastric sleeve and micronutrients supplementation: our experience. Journal of obesity1Department of Clinical Sciences, Sapienza University of Rome, Policlinico Umberto I, 00161 Rome, Italy2 Surgical-Medical Department for Digestive Diseases, Sapienza University of Rome, Rome, Italy Correspondence should be addressed to D. Capoccia, danilacapoccia@yahoo.it Received 12 December 2011; Accepted 4 January 2012
3. Roth CL, Elfers C, Kratz M, &Hoofnagle AN. (2011). Vitamin D deficiency in obese children and its relationship to insulin resistance and adipokines. Journal of obesity, 2011. Received 10 August 2011; Accepted 17 September 2011 Academic Editor: P. Trayhurn
4. ErlendTAasheim, SofiaBjorkman, Torgeir T Sovic, myEngstrom, Susanna E Hanvold, Tom Mala, Torstenolbers, Thomas Bohme vitamin status after bariatric surgery: a randomized study of gastric bypass. the American Journal of clinical Nutrition,Volume 90, Issue1, 1 July 2009 pages 15-22,https://doi.org/10,3945/ajcn.2009.27583
5. Barbara M. Rhode, poul Arseneau, Bernard A Cooper, Max Katz, Brain M Gilfix, and Lloyd D Maclean. Vitamin B-12 deficiency after gastric surgery for obesity. The American journal of clinical nutrition, 63(1), 103-109.
6. Yeongkeun kwon MD, Hyun Jung Kim, M.P.H, phD, EmanueleLomenzo, MD, ph.D.F.A.C.S., F.a.S.M.b.S, Sungsoo. Park, M.D.ph.D, SamueleSzomstein, M.D, F.A.C.S., F.A.S.M.B.A., Raul J. Rosenthal, M.D., F.A.S.M.B.S., Article in American journal of clinical nutrition in January 1993 for assessment of Vitamin B12 after Laparoscopic Sleeve Gastrectomy.
7. Sarkhosh, K, Birch DW, Sharma A, & Karmali, S. (2013). Complications associated with laparoscopic sleeve gastrectomy for morbid obesity: a surgeon's guide. Canadian journal of surgery, 56(5), 347. Rhode, BM, Arseneau P, Cooper BA, Katz M, Gilfix BM., & MacLean LD. (1996)
8. Dix CF, Bauer JD, & Wright OR. (2017). A systematic review: vitamin D status and sleeve gastrectomy. Obesity surgery, 27(1), 215-225. Centre for Dietetic Research, School of Human Movement and Nutrition Sciences, The University of Queensland, Brisbane, QLD 4072, Australia
9. Nina Sauer1#, Jan wieneke1, clarissa Schulze zur Wiesfch1 Stefan wolter Oliver Mann2 jens Aberle1. complication, mineral And vitamin Deficiencies after Roux-en-Y Gastrectomy and Laparoscopic Sleeve gastrectomySurgical Science, 2013, 4, 547-553 Published Online December 2013 (http://www.scirp.org/journal/ss)http://dx.doi.org/10.4236/ss.2013.412106 Open
10. Taha Saif MD, Gladys W. Strain phD, Gregory dakin MD, Michel Gagner MD, Ricardo Costa BS, and Alfons Pomp MD. Evaluation of nutrient status after laparoscopic sleeve gastrectomy 1,3, and 5 years after surgery. Department of surgery. Weill College of medicine, New York. Department of surgery, Florida International University, Miami, Florida. Published in final edited form as: Surg. Obes.Relat. Dis. 2012; 8(5): 542–547. doi:10.1016/j.soard.2012.01.013