

Original Research Article

DOI: <https://dx.doi.org/10.18203/2349-2902.ijssurgery20231377>

Vitamin D levels in relation to bariatric surgery: a single center experience

Husain Alaradi*

Department of Surgery, Salmaniya Medical Complex, Manama, Bahrain

Received: 09 April 2023

Accepted: 17 April 2023

***Correspondence:**

Dr. Husain Alaradi,

E-mail: hussaimulla80@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Bariatric surgery has become a major component of the treatment of obesity and obesity related illnesses such as diabetes mellitus, hypertension and dyslipidemia. However, bariatric surgeries have been linked to some disturbances in the overall micronutrient profile in the post-operative period. In obese patients, visceral fat, is most closely related to the development of metabolic syndrome (MS). In this respect, vitamin D is of major importance, since numerous studies have shown that it can impact the prevention of MS, immune diseases and some cancers. Furthermore, given its inverse association with adiposity, high rates of vitamin D deficiency (VDD) have been found in obese patients, including those with morbid obesity who are candidates for bariatric surgery.

Methods: A cross sectional study design was carried out after obtaining the required ethical approval. The surgery register was scanned for all bariatric procedures done from January 2018 till December 2018. Data were retrieved about each case through ISEHA labs, progress notes, medications summary, radiological images. Files were retrieved from the filing department for cases who were admitted to the surgical HDU or ICU (as they still use paper documentation). All data were compiled into a detailed excel sheet.

Results: The total number of included patients was 232, with a mean age of 41.3. The majority of patients underwent laparoscopic Roux-En-Y bypass (67.2%), while laparoscopic sleeve gastrectomy was done in 32.8% of patients. As expected, mean body mass index (BMI) dropped down from (46.3 to 35.1). The striking result noted was the percentage of patients who had vitamin D deficiency pre bariatric surgery (44 patients, 19%). This percentage has increased up to (73 patients, 31.4%) post bariatric surgery at 12 months follow up.

Conclusions: Bariatric surgery is linked to increased incidence of vitamin D deficiency post operatively. Vitamin D level close monitoring in peri-operative management of bariatric patients is recommended to avoid potential complications.

Keywords: Laparoscopic sleeve gastrectomy, Laparoscopic mini bypass, Laparoscopic Roux en Y bypass, Vitamin D deficiency

INTRODUCTION

Bariatric surgery has become a major component of the treatment of obesity and obesity related illnesses such as diabetes mellitus, hypertension and dyslipidemia.¹ However, bariatric surgeries have been linked to some disturbances in the overall micronutrient profile in the post-operative period.²

In obese patients, visceral fat, is most closely related to the development of metabolic syndrome (MS). In this respect, vitamin D is of major importance, since numerous studies have shown that it can impact the prevention of MS, immune diseases and some cancers. Furthermore, given its inverse association with adiposity, high rates of vitamin D deficiency (VDD) have been found in obese patients, including those with morbid obesity who are candidates for bariatric surgery.³

On the other hand, bariatric surgery leads to various nutritional and vitamin deficiencies, including vitamin D and others, requiring adequate follow up postoperatively. Vitamin D deficiency in the bariatric surgery population could be related to obesity itself as mentioned above, or it could be related to the type of the surgical procedure performed or its complications.⁴

Current evidence is conflicting as to whether the pre-op VDD would improve after bariatric surgery. Some would argue that vitamin D level would even decrease post-operatively.⁵

To this date, there is no clear data regarding VDD in relation to bariatric surgery in Bahrain. This research aims at exploring the current trend of VDD the bariatric surgery population in SMC, Bahrain. Our results will aid the involved medical professionals in providing the best evidence-based management of their patients.

Aim

Aim of the study was to provide clear data on the trend of vitamin D deficiency post bariatric surgery in Salmaniya Medical Complex (SMC), Bahrain.

METHODS

Study design

It was a cross sectional study.

Study population

All cases admitted for bariatric surgery, either laparoscopic Roux en Y, or laparoscopic sleeve gastrectomy to the SMC from year 2018 till 2022.

Ethical approval

The study was discussed and approved by the research and ethics committee at the Salmaniya Medical Complex, Manama, Bahrain.

Inclusion criteria

The date of surgery at SMC: from 01 January 2018 to 31 December 2022. Age of patients were from 18 to 60 years, the type of bariatric surgery were sleeve gastrectomy and Roux-En-Y bypass. These two procedures were only included as they were the most commonly performed bariatric procedures at our center. The other bariatric procedures were not included to avoid bias.

Exclusion criteria

Re-do bariatric surgery and any other bariatric procedure other than sleeve gastrectomy and Roux-En-Y gastric bypass were excluded from the study. Patients with

chronic kidney disease and hyperparathyroidism were also excluded.

Methods

The surgery register was scanned for all bariatric procedures done from 01 January 2018 to 31 December 2022. Data were retrieved about each case through ISEHA labs, progress notes, medications summary, radiological images. Files were retrieved from the filing department for cases who were admitted to the surgical HDU or ICU (as they still use paper documentation).

All data were compiled into a detailed excel sheet.

Statistical analysis

Continuous variables were described as means and standard deviations while categorical variables were described as proportions. Version 22 of SPSS was used to run the statistical tests with the help of a specialized statistician.

RESULTS

Table number 1 summarizes the baseline characteristics of our study subjects. The total number of cases that underwent the mentioned bariatric surgeries at our institution and met our inclusion criteria, through years 2018 till 2022 were 232 cases. 156 of which underwent laparoscopic Roux-En-Y gastric bypass (67.2%) and 76 patients underwent laparoscopic gastric sleeve (32.8%).

143 of these cases were females and 89 males. The mean age was 41.3. Data regarding patient's comorbidities were documented. Diabetes mellitus, hypertension, and dyslipidemia were the most common comorbidities with a percentage of 52.6%, 32%, and 39.6% respectively.

Table 1: Baseline characteristics of the study population preoperatively.

Variable	Numbers/percentage
Total included cases	232
Age (mean)	41.3
Females	143 (61.6)
Males	89 (38.3)
DM	122 (52.6)
HTN	74 (32)
Dyslipidemia	92 (39.6)
BMI pre op (mean)	46.3
Vitamin D deficiency (pre-operative)	44 (19)
Laparoscopic Roux-En-Y gastric bypass	156 (67.2)
Laparoscopic gastric sleeve	76 (32.8)

Table 2 summarizes the BMI changes noted in the laparoscopic Roux-En-Y gastric bypass when compared to laparoscopic gastric sleeve over a follow up period of 12 months. The laparoscopic Roux-En-Y gastric bypass group showed a decline in the mean BMI from 47.1 to 35 (12.1 drop in mean BMI over one year), while the laparoscopic gastric sleeve group showed a decline in the mean BMI from 45.4 to 35.2 (10.2 drop in mean BMI over one year). However, this difference (12.1 versus 10.2) was not statistically significant.

The striking result noted was the percentage of patients who had vitamin D deficiency pre bariatric surgery was (44 patients, 19%). This percentage has increased up to (73 patients, 31.4%) post bariatric surgery at 12 months follow up.

Table 2: Comparison between the two procedures performed in terms of BMI changes.

Variables	Laparoscopic Roux-En-Y gastric bypass	Laparoscopic gastric sleeve	P value
Number of patients/percentage	156 (67.2)	76 (32.8)	0.001
Pre-op BMI (mean)	47.1	45.4	0.834
Post-op BMI (mean)	35	35.2	0.962

Table 3: Comparison between vitamin D deficient group and normal vitamin D group at 12 months follow up post bariatric surgery.

Variables	Vitamin D deficient group (post operatively) (%)	Normal vitamin D group (post operatively) (%)	P value
Total bariatric surgeries combined	73 (31.4)	159 (68.5)	0.004
Lap sleeve gastrectomy	21 (28.7)	71 (44.6)	0.072
Lap Roux-En-Y bypass	52 (71.2)	88 (55.3)	0.001
Age (mean)	47.4 (SD 16.03)	34.7 (SD 14.14)	0.001
Male	30 (41.1)	90 (56.6)	0.342
Female	43 (59.9)	69 (43.4)	0.001
BMI (mean)	38.3 (SD 9.02)	35.2 (SD 7.23)	0.632
Length of hospital stay (mean)	3.4 (SD 1.01)	2.3 (SD 1.02)	0.734
ICU admission	8 (10.9)	3 (1.29)	0.642
Re-admission rate	5 (2.1)	2 (0.9)	0.830
Re-operation rate	2 (0.9)	1 (0.4)	0.615
Leakage rate	1 (0.4)	0	

DISCUSSION

Obese patients are at risk of multiple nutritional deficiencies, especially vitamin D deficiency, before bariatric surgery.⁶

The vitamin D insufficiency is very prevalent in obese subjects. Many theories have been suggested to explain this fact, but the most important mechanism appears to be the sequestration of vitamin D in adipose tissue. The availability of vitamin D stored in the fatty tissues and the mechanisms that govern its mobilization to the serum are still poorly elucidated.⁷

Vitamin D deficiency was noted to be significantly higher in females (N:43, 59.9%, p value 0.001). Laparoscopic Roux-En-Y bypass was found to be significantly associated with post-operative vitamin D deficiency (52, 71.2%, p value 0.001).

Age was also a significant variable in association with development of vitamin deficiency post operatively. Mean age in the post-operative vitamin D deficiency group was 47.4 compared to 34.7 in the normal vitamin D level group, p value 0.001.

Length of hospital stay, ICU admission, re-admission rate and re-operation rates were not significantly associated with development of VDD.

Bariatric surgery and substantial weight losses associated with it, expose even more obese patients to multiple nutritional deficiencies including vitamin D.⁸ Malabsorptive surgical procedures are associated with a higher risk of deficiency in vitamin D than those of restrictive surgery.⁹

The obesity rate in Bahrain is considered very high, as the obesity rate among the population reached 39.5% of adult females, and 28.4% of adult males. Bahrain's obesity prevalence is higher than the regional average of 10.3% for women and 7.5% for men. At the same time, diabetes is estimated to affect 11.1% of adult females and 12.8% of adult males.¹⁰

This is a cross-sectional study conducted on patients admitted to the largest hospital in Bahrain (Salmaniya medical complex). We studied the cases admitted with obesity from the year 2018 till 2022. Our center conducts bariatric surgery cases with an average number of 120 cases per year. Our numbers in the years 2020 and 2021 were affected by the COVID pandemic as the elective cases were put on-hold during these years. Our results are in line with most of the reported studies about vitamin D relationship to obesity and bariatric surgery.

Vitamin D has a crucial role in improving physiological function in both skeletal and extra skeletal tissues. It is essential for intestinal calcium absorption, homeostasis and bone mineralization, especially during infancy, childhood and puberty. Only 10–15% of dietary calcium is absorbed without vitamin D. Serum 25-hydroxyvitamin D [25(OH)D] levels less than 50 nmol/l can lead to a marked decrease in intestinal calcium absorption. This is associated with increased parathyroid hormone secretion and decreased insulin like growth factor 1. Serum 25(OH)D level is directly connected to bone mineral density with a maximum density attained when the 25(OH)D level is ≥ 100 nmol/l. Severe vitamin D deficiency impairs bone mineralization leading to osteomalacia and rickets. Recent evidence shows that the role of vitamin D goes beyond calcium and phosphorous metabolism. Many extra skeletal illnesses have been associated with vitamin D deficiency, such as those related to fuel metabolism, the cardiovascular system, cancer and the immune system.

This study confirms the efficacy of both laparoscopic roux En Y gastric bypass and laparoscopic sleeve gastrectomy in reducing BMI at a short term follow up period. Mean BMI dropped over a period of 12 months follow up from (46.3 to 35.1).

Our study found out that despite the marked decrease in BMI levels post- operatively, which in theory should improve the metabolic syndrome which should improve the vitamin D metabolism. We found that despite the significant drop in BMI, VDD rates became higher. This can be explained by the malabsorptive nature of the surgeries performed. This is also confirmed by the significant difference showed in the laparoscopic Roux-En-Y group as discussed in the results section.

Post-operative complications did not seem to have any effect on the incidence of vitamin D deficiency rates.

Our study had some limitations such as the COVID period that affected the sample size as mentioned earlier. The types of bariatric surgeries performed were limited to only two procedures, other procedures were not done frequently to be effectively included. Our main limitation is the lack of data regarding vitamin D supplementation pre and post operatively, which might have an impact of the further management protocols. The follow up period was limited

to 12 months only. Further studies with longer follow up periods are encouraged to validate our results.

CONCLUSION

This is a cross-sectional study on patients admitted for bariatric surgery during the years 2018 till 2022 to the Salmaniya medical complex, Bahrain, to evaluate the trend of vitamin D deficiency post bariatric surgery. The study found that the percentage of patients who had vitamin D deficiency pre bariatric surgery was (44 patients, 19%). This percentage has increased up to (73 patients, 31.4%) post bariatric surgery at 12 months follow up.

This study highlights the importance of managing the patients' expectations regarding their vitamin D levels post operatively, and also serves as an evidence to encourage health care workers to monitor and replace the vitamin D levels post bariatric surgery.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Du X, Fu XH, Peng BQ, Luo R, Hu JK, Cheng Z. Resolution of metabolic syndrome and related metabolic disorders after bariatric surgery: comparison of sleeve gastrectomy and gastric bypass. *Surg Obes Relat Dis.* 2018;14(9):1348-56.
2. Padwal R, Klarenbach S, Wiebe N, Birch D, Karmali S, Manns B, et al. Bariatric surgery: a systematic review and network meta-analysis of randomized trials. *Obes Rev.* 2011;12(8):602-21.
3. Obispo Entrenas A, Legupin Tubio D, Lucena Navarro F, Martin Carvajal F, Gandara Adan N, Redondo Bautista M, et al. Relationship Between Vitamin D Deficiency and the Components of Metabolic Syndrome in Patients with Morbid Obesity, Before and 1 Year After Laparoscopic Roux-en-Y Gastric Bypass or Sleeve Gastrectomy. *Obes Surg.* 2017;27(5):1222-8.
4. Chakhtoura MT, Nakhoul NN, Shawwa K, Mantzoros C, El Hajj Fuleihan GA. Hypovitaminosis D in bariatric surgery: A systematic review of observational studies. *Metabolism.* 2016;65(4):574-85.
5. Gasmi A, Bjørklund G, Mujawdiya PK, Semenova Y, Peana M, Dosa A, et al. Micronutrients deficiencies in patients after bariatric surgery. *Eur J Nutr.* 2022;61(1):55-67.
6. Araújo MM, Mendes MM, Lanham-New SA, Borges LPSL, da Costa THM, de Carvalho KMB, et al. Frequency of Vitamin D Deficiency and Associated Factors in Long-term Bariatric Surgery Patients: a Cross-sectional Study. *Obes Surg.* 2022;32(7):2386-96.

7. Galyean S, Syn D, Subih HS, Boylan M. Improving vitamin D status in bariatric surgery subjects with monthly high-dose ergocalciferol. *Int J Vitam Nutr Res.* 2022;92(2):109-17.
8. Lespessailles E, Toumi H. Vitamin D alteration associated with obesity and bariatric surgery. *Exp Biol Med (Maywood).* 2017;242(10):1086-94.
9. Mangan A, Le Roux CW, Miller NG, Docherty NG. Iron and Vitamin D/Calcium Deficiency after Gastric Bypass: Mechanisms Involved and Strategies to Improve Oral Supplement Disposition. *Curr Drug Metab.* 2019;20(3):244-52.
10. Global nutrition report. Bahrain. Available at: [https://globalnutritionreport.org/resources/nutrition-profiles/asia/western-asia/bahrain/#:~:text=39.5%25%20of%20adult%20\(aged%2018,2012.8%25%20of%20adult%20men.](https://globalnutritionreport.org/resources/nutrition-profiles/asia/western-asia/bahrain/#:~:text=39.5%25%20of%20adult%20(aged%2018,2012.8%25%20of%20adult%20men. Accessed on 12 January 2023.) Accessed on 12 January 2023.

Cite this article as: Alaradi H. Vitamin D levels in relation to bariatric surgery: a single center experience. *Int Surg J* 2023;10:837-41.