Original article

Quality of life change seen after Diverted Mini Gastric Bypass Surgery in Obese Population: Retrospective research analysis

Bariatric Surgery Series: Paper III

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Abstract

Background: With an increase in life expectancy all over the globe, morbid obesity and obesity-related diseases negatively impact the overall quality of life (QoL). ***Aim:*** The study aimed to assess the QoL post-Diverted Mini Gastric Bypass (dMGB), focusing on weight loss achieved, comorbidity resolution, and change in QoL after the surgery. Setting: Single private institute, India ***Methods :*** Data from patients who underwent a laparoscopic primary dMGB from August 2020 to August 2021 by one surgeon were retrospectively analyzed. The patients were followed up at 3,6,9, and 12 months from the surgery date. Data were assessed using the Bariatric Analysis and Reporting Outcome System- II (BAROS- II) form based on three major areas: percentage weight loss, comorbidity resolution, and QoL. The variation in QoL was assessed using the Moorehead Ardelt QoL questionnaire, which addresses self-esteem, physical activity, social gathering, and sexual life. ***Results:*** Forty-one patients were included in the final analysis. The average age and pre-operative body mass index (BMI) was 45.5 yrs. and 44.5 kg/m^2, respectively. The cohort had 60.9% of males and 39.1% females. The pre-operative average total QoL score was 0.65 ± 0.2. At 12 months, the average BMI and average total QoL were 28.03 kg/m^2 and 5.35 ± 0.3, respectively, $p<0.001$. ***Conclusion:*** At one year, the dMGB surgery effectively improves the overall QoL.

Keywords: *Quality of life (QoL), BAROS- II, Moorehead Ardelt Questionnaire, Obesity, Bariatric Surgery, Weight Loss.*

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Introduction

Morbid obesity is still a significant concern in India, especially with a large population living below the poverty line [1, 2]. Treatment options for obesity vary, from medical management to dietary interventions and surgical procedures [3, 4]. Bariatric surgery is the only proven long-term treatment of choice for obesity and obesity-related comorbidities [5, 6].

One Anastomosis Gastric bypass (OAGB), Mini Gastric Bypass (MGB), was first introduced in 1997 to manage obesity. Many long-term studies on MGB have shown its safety and effectiveness in patients with morbid obesity [7-10]. Diverted MGB (dMGB) is a relatively new procedure; however, it is a slightly modified version of the traditional MGB surgery [11, 12]. This variation in MGB was initially named "sleeved gastric bypass" because of the long and

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thin pouch resembling the "sleeve gastrectomy" in the upper GI series. It was later called diverted MGB— "dMGB" [12-14]. It involves the OAGB-MGB with the Roux-en-Y diversion on the top of a long pouch with a non-calibrated anastomosis [12, 15]. It has a long, narrow pouch and a wide anastomosis, resulting in mild restriction, eventually minimizing the potential risk of postoperative biliary reflux and marginal ulcer seen with traditional MGB surgery [16] (Figure 1). Also, the biliopancreatic limb is long (usually 150- 200 cm or more), providing some fat malabsorption. In all aspects, except in reducing the daily bowel movements, dMGB is like MGB-OAGB regarding morbi-mortality, post-operative course, weight loss, and metabolic control considered better procedure [12, 17-20].

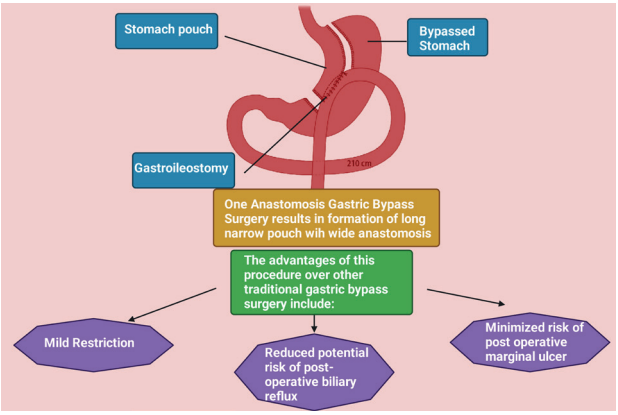

Figure 1: Demonstrates the advantages of One Anastomosis Gastric Bypass Surgery over other Traditional Gastric Bypass Surgery. This figure has been drawn with the premium version of BioRender (https://biorender.com/ accessed on 26 July 2023) with license number SE25NJIS62. Image credit: Rahnuma Ahmad.

The impact on quality of life with dMGB is not very well studied, especially in the Indian population [21]. The surgical procedure carried out in the current study was through laparoscopy. The multiple studies assess the Quality of Life (QoL) pre and post-dMGB utilizing the Moorehead Ardelt Questionnaire [22-24]. Additionally, the Bariatric Analysis and Reporting Outcome System- II (BAROS- II) has been developed and used to evaluate the Quality of Life. It is a self-reporting questionnaire used pre-surgery and post-surgery, focusing on the patient's physical activity, self-esteem, social life, sex life, and work life along with % of excess weight loss and comorbidity resolved as well as weight regain [25, 26]. The later questionnaire (BAROS- II) incorporates the Moorehead-Ardelt Quality of Life Questionnaire [24, 27]. The study aimed to assess the QoL pre and post-dMGB using the BAROS- II.

Materials and Methods

Enrollment and Randomization of the Study

A group of 41 subjects who underwent Laparoscopic dMGB were enrolled between August 2020 to August 2021 and were followed up at 3,6,9, and 12 months after surgery. Written informed consent was obtained from all the subjects before inclusion in the current research. The study participants were informed about all the possible benefits, side effects, and risks associated with the surgical interventions and the purpose of the study and future publication. Additionally, the best form of treatment, its efficacy, and any potential consequences were explained and reviewed with the patient, family, and the treating surgeon if the patient qualified as a candidate for surgical treatment**.** All the patients underwent a thorough examination that included anthropometric measures, diet history with a 24-hour. Diet recall and medical history.

They included subjects aged 18–73 years who had failed to achieve sustained weight loss through medical management and lifestyle measures. The study subjects were both genders, with a median (IQR) pre-operative BMI of = 44.35 kg/m2. Exclusion criteria were a history of previous weight loss surgery, severe cardiopulmonary disease, cancer, oral steroid treatment, and psychiatric illness. These requirements align with the recommended bariatric surgery indications [28-31]. All subjects were analyzed using the BAROS-II form. The scores are based on a range of +0.5 to -0.5 points scale (+0.5= Best and -5= Worst) (Figure 2). The questionnaire gives a total quality of life score where each category is scored individually. A final score of 0-9 is calculated, and the outcome is interpreted as a failure, fair, good, very good, and excellent [32]. The higher the score in the questionnaire, the higher the patient's quality of life.

Anthropometric Evaluation

The anthropometric evaluation was done using weight, height, and BMI. The patients were weighed on a Bioelectrical Impedance machine (In Body 770). The size was measured with a BSM 170 Body measuring scale.

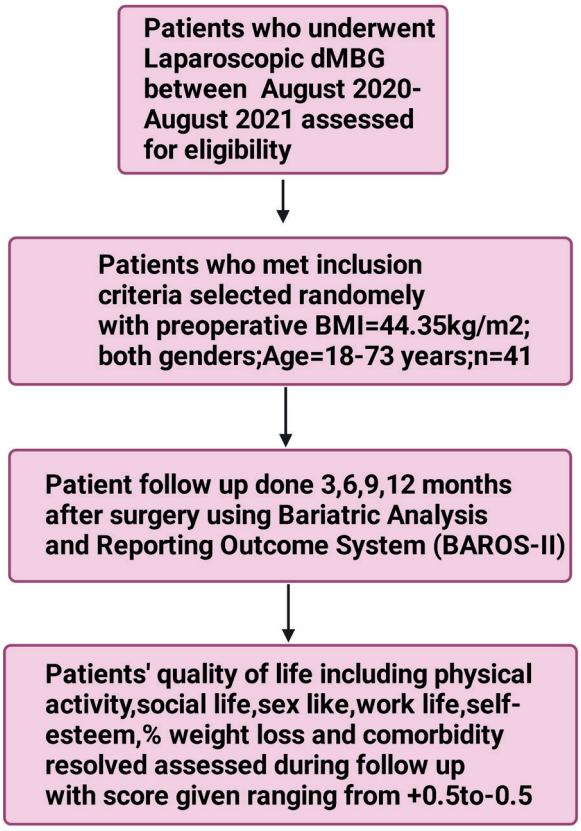

Figure 2: Illustrates the flow chart for the study method performed to observe the quality of life following Diverted Mini Gastric Bypass Surgery. dMGB: Diverted Mini Gastric Bypass Surgery. This figure has been drawn with the premium version of BioRender (https://biorender.com/ Accessed on 27 July 2023) with license number KF25NPJ6R2. Image credit: Rahnuma Ahmad.

Surgical Intervention

The procedure was carried out laparoscopically. Pneumoperitoneum is created using a 5 mm Endopath at Palmer's point, remaining the 3 ports – 11 mm supra-umbilical port, 12mm right of side correct Rectus muscle port, and 5 mm port in right of Hypochondrium. Gastroesophageal junction dissection started by retracting the fundus and dividing the peritoneum overlying the GE junction using the Goldfinger instrument. The greater omentum was divided vertically to the upper border of the transverse colon and further divided transversely. DJ flexure was identified, and a loop of small bowel was traced from there up to 125 cm. Loop pulled up colic and anchored to the greater curvature opposite the incisura. Dissection for the gastric pouch started by creating a window in the lesser curve near the incisura. A subsequent stapler firing multiple purple and blue staplers made the required stomach pouch of around 100 ml. 36 Fr Gastric Calibration Tube was used. Gastro-jejunostomy (GJ) stoma of 5 cm was created by a blue stapler, and enterotomy was closed with another blue stapler. The BP limb was divided proximal to GJ anastomosis, and a Jejunno-jejunostomy was formed 100 cm distal to GJ to make a Roux-type anastomosis. Staple line hemostasis secured. Skin closed using staplers. Dressing applied.

Statistical Analysis

All calculations were performed using SPSS 26 software (IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp). Quantitative variables were defined by mean and standard deviation. Qualitative variables were determined by percentage. The paired t-test was used to study the differences between meanings over time. The significance was set at $p<0.05$.

Ethics Statement

This study was conducted in a high-volume bariatric center in India. The study was approved by the Institutional ethics committee Human Research- Asian Bariatrics Hospital, SG Highways, Ahmedabad, Gujarat, India, with Reference *No.*: IECHR-AB/2020/09, Dated November 26th, 2020.

Project Details

This is the second paper of the principal author of the Bariatric Surgery project. The earlier Paper-I was published in the Bangladesh Journal of Medical Science (https://www.banglajol.info/index.php/BJMS/article/view/66965) [33].

Results

The sample included 41 patients who underwent dMGB and completed 12-month follow-ups, with a median (IQR) age of 45.5 (18,73) years. The median (IQR) pre-operative BMI was 44.35 (41.14, 49.09) kg/m^2, and the median (IQR) pre-operative excess weight (EW) was 51.23 (42.87, 65.03) Kg.

Table 1 shows the trends of weight-loss outcomes (TWL%, WL, EWL%, BMI, and change in BMI) during a 12-month postoperative period. In these 12 months, postoperative weight, BMI, and EW had significant decreasing trends, whereas WL, TWL%, EWL%, and BMI loss had substantial increasing trends ($p<0.001$ for all).

Table 1: Measure of Change in The Variants throughout The Study.

Variables*	Before surgery (n=41)	1 month (n=41)	3 months (n=38)	6 months (n=35)	9 months (n=32)	12 months (n=41)	P Value
Weight (kg), median (IQR)	120(108, 136)	105.9(95, 120)	94(84, 107)	85(75.7, 96)	79(70, 89)	75.5(67, 85)	<0.001
BMI (kg/m2), median (IQR)	44.5 (41.10, 49.30)	39.41 (36.14, 43.50)	35.1(31.95, 39.98)	31.51 (28.60, 35)	29.13 (26.64, 32.53)	28.03 (25.39, 31.41)	<0.001
BMI loss (kg/m2), median (IQR)	-	5.12(4.25, 6.23)	9.55(8.32, 10.95)	13.22 (11.42, 15.06)	15.43 (13.3, 17.58)	16.88 (14.15, 19.34)	<0.001
EW (kg), median (IQR)	51.23 (42.87, 65.03)	38.34 (29.79, 50.31)	26.61(18.76, 37.33)	17.29 (9.57, 26.37)	10.98 (4.52, 20.24)	7.98(1.0, 17.28)	<0.001
WL (kg), median (IQR)	-	14(11, 17)	26(22, 30)	35(30, 41)	41(35, 47.5)	45(37, 52)	<0.001
TWL %, median (IQR)	-	11.48 (9.73, 13.46)	21.3(18.60, 24.31)	29.26 (26.05, 32.79)	34.31 (30.52, 38.09)	36.92 (32.98, 41.67)	<0.001
EWL %, median (IQR)	-	26.5 (21.28, 32.72)	48.76(40.74, 58.10)	66.89 (56.37, 77.90)	78.34 (67.09, 90.58)	84.94 (71.40, 97.65)	<0.001

Notes: *Data are given as median (IQR). IQR=Interquartile range; BMI=Body mass index; EW=Excess weight; WL=Weight loss; EWL=Excess WL; TWL=Total WL.

Comorbidities pre-surgery noted in patients were Hypertension in 26.8%, type 2 diabetes mellitus (T2DM) in 53.6%, and obstructive sleep apnea (OSA) in 12.1% of the cases. Table 2 shows the patients' demographic and clinical characteristics, comorbidities, and pre-operative data.

Table 2: Number of Patients with Conditions Enrolled in The Study.

Variables	N=41
Age (years), median (IQR)	**45.5(18, 73)**
male, n (%)	**25 (60.9)**
Weight (kg), median (IQR)	**120.00 (108, 135)**
T2DM, n (%)	**22 (53.6)**
Hypertension, n (%)	**11 (26.8)**
Sleep apnea, n (%)	**5 (12.1)**

Notes: BMI=Body mass index; IQR=Interquartile range; T2DM=Type 2 diabetes mellitus.

Resolution of OSA was noted in 100% of patients at 12 months. T2D and HTN resolution was reported in 91% and 81.8% of the patients, respectively, at 12 months (Figure 3).

Patients completed the BAROS-II questionnaire, and the results were used to calculate their pre-operative quality of life score and % weight change. The pre-operative average total QoL score was 0.65 ± 0.2. At 12 months, the average total QoL score was 5.35 ± 0.3 (Figure 4). Each parameter is better, with a slight dip in the middle.

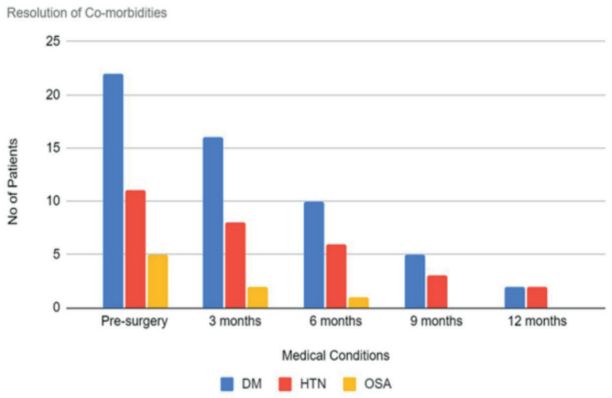

Figure 3: Resolution of Comorbidities Over 12 months of the surgery

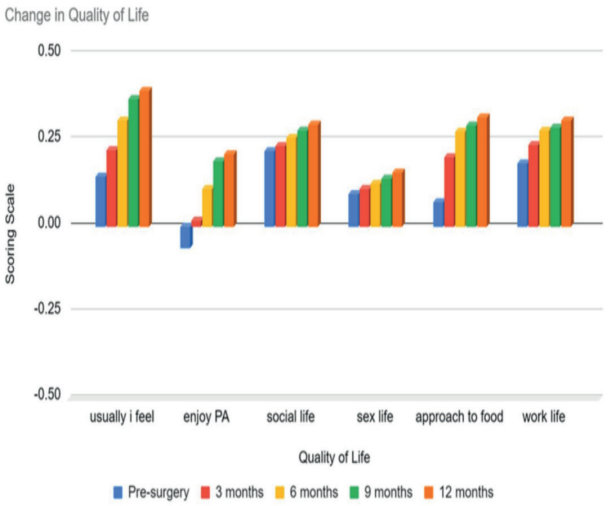

Figure 4: Change in the Quality of Life over 12 months from the date of Surgery

QOL has been shown to improve following bariatric surgery [34]. It is also likely that pre-existing and/or post-surgical anthropometrics, psychological and social factors interact with weight loss to influence the improvement in QOL following bariatric surgery [35-37]. The values in Table 3 below show that all subjects included demonstrated improvements in QOL following bariatric surgery when evaluated based on the BAROS-II form. A significant weight loss was seen post-12 months of the surgery, leading to a decrease in the BMI while increasing the overall QOL. This was statically confirmed by the Karls Coefficient of Correlation, where a positive correlation (r-value = 0.8) was calculated.

Table 3: Change in Quality of Life Score Versus Weight.

Quality of Life		Weight
Month	Value*	BMI (kg/m^2)
Preoperative	0.65 ± 0.2	44.5 (41.1, 49.3)
12 months	5.35 ± 0.3	28 (25.3, 31.4)

Notes: Value expressed as mean ± standard deviation. *Value expressed as median IQR=Interquartile range.

Discussion

Obesity is a chronic disease, and bariatric surgery is proven to be the most effective modality of treatment for the same. Bariatric surgery, despite its well-documented successes, can fail in some patients, particularly in primary restrictive procedures [38, 39]. Diverted OAGB-MGB is now an established bariatric procedure and has shown to be an effective primary procedure (Figure 5) [38]. It is reported that OAGB-MGB is comparable to or better than sleeve gastrectomy (SG) and Roux en Y Gastric Bypass (RYGB) in the super-obese population [40, 41]. A recent publication has concluded it to be a safe and effective metabolic procedure in patients with lower BMI [8, 18, 19].

This study aimed to evaluate the effect of dMGB on QoL concerning short-term outcomes. There was a significant positive effect on the quality of life owing to substantial weight loss, resolution of comorbidities, and generalized improvement in self-esteem in the first year. Complications associated are primarily due to decreased intake amounts of specific nutrients. Our findings were in the same line as earlier studies [42, 43]. Macronutrient deficiencies can include severe protein-calorie malnutrition and fat malabsorption [42]. The most common micronutrient deficiencies

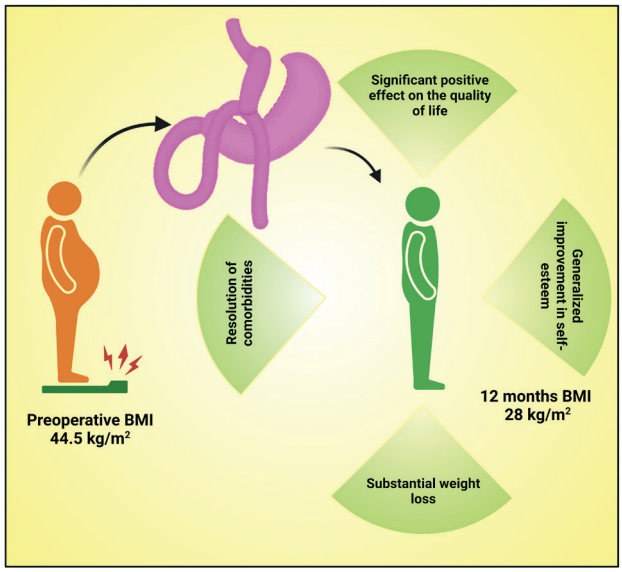

Figure 5: Schematic diagram showing various effects of one anastomosis gastric bypass- mini gastric bypass (OAGB-MGB) in obese patients. This figure has been drawn with the premium version of BioRender (https://biorender.com/ Accessed on 29 July 2023) with license number VN25O0VY3B. Image credit: Susmita Sinha.

are vitamin B_{12}, iron, calcium, and vitamin D [44, 45]. Other micronutrient deficiencies that can lead to severe complications include thiamine, folate, and fat-soluble vitamins (Figure 6) [46, 47]. Reassurance, solacing, and keeping an eye on regarding nutrients and mineral boosting are essential for treating and preventing nutritional and metabolic impediments after bariatric surgery [42, 47, 48].

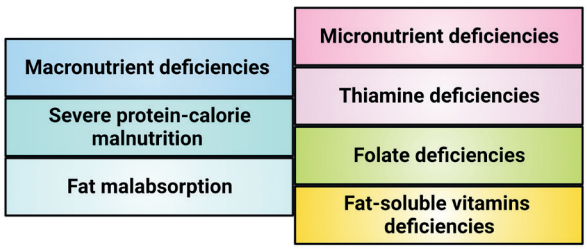

Figure 6: Chart showing nutrient deficiencies following OAGB-MGB surgery. This figure has been drawn with the premium version of BioRender (https://biorender.com/ Accessed on 29 July 2023) with license number RK25O11YHT. Image credit: Susmita Sinha.

Although BAROS-II is intended to be used after 1 year, this study also wanted to assess how QoL changed over time, which can only be studied if

prospective data is collected at regular intervals. Significant weight loss can explain the increase in QoL score during the first year. The current study was similar to earlier research reports [49, 50]. Patients experience more mobility due to fewer complications like joint pain. The current findings are also similar to earlier research reports [51, 52]. We noticed that the scores were low for the group between 6 to 9 months, probably when the initial euphoria of weight loss settles down, and some of them might have issues with food intake and static weight. But this trend was again reversed after 9 months when they had a clear picture of themselves and their comorbidities.

It is noted that patients on dietary attempts for weight loss stopped eating for apparent health and cosmetic reasons, and the same happens for post-bariatric patients for fear of vomiting [53, 54]. This fear of vomiting in post-op patients primarily develops from the restrictive bariatric procedures, which offer marked restrictions in eating patterns [55, 56]. Lap adjustable gastric band (LAGB), Lap Sleeve Gastrectomy (LSG), and to some extent, Lap RYGB are the standard procedures for this post-operative change. Diverted Mini Gastric Bypass evolved as a combined restrictive and malabsorptive procedure, relying more on malabsorption than restriction for weight loss and maintenance [57, 58]. Also, the stoma size in dMGB is more than that of RYGB, making Diverted MGB a relatively lower-pressure gastric pouch [12, 41, 59, 60].

Conclusion

Diverted MGB seems to be a promising modification of MGB or, for that matter, an amendment of an RYGB with an extended pouch. It avoids bile in the esophagus and its potential consequences. dMGB combines the advantages of the MGB-OAGB (mild restriction and moderate malabsorption) with the anti-reflux effect of the Roux-en-Y diversion, which aids in maintaining a good quality of life. The short-term results of Diverted MGB show a favorable response from the patients. A more comprehensive multicentric study with a long-term follow-up would help establish it as a Gold standard procedure.

Consent for Publication

The author reviewed and approved the final version and has agreed to be accountable for all aspects of the work, including any accuracy or integrity issues.

Disclosure

The author declares that they do not have any financial involvement or affiliations with any organization, association, or entity directly or indirectly with the subject matter or materials presented in this editorial. This includes honoraria, expert testimony, employment, ownership of stocks or options, patents, or grants received or pending royalties.

Data Availability

The data is exclusively available from the principal author for research purposes only.

Authorship Contribution

All authors contributed significantly to the work, whether in the conception, design, utilization, collection, analysis, and interpretation of data or all these areas. They also participated in the paper's drafting, revision, or critical review, gave their final approval for the version that would be published, decided on the journal to which the article would be submitted, and made the responsible decision to be held accountable for all aspects of the work.

References

1. Luhar S, Mallinson PAC, Clarke L, Kinra S. Trends in the socioeconomic patterning of overweight/obesity in India: a repeated cross-sectional study using nationally representative data. *BMJ Open*. 2018;**8**(10):e023935. doi: 10.1136/bmjopen-2018-023935.
2. Nguyen PH, Scott S, Headey D, Singh N, Tran LM, Menon P, Ruel MT. The double burden of malnutrition in India: Trends and inequalities (2006-2016). *PLoS One*. 2021;**16**(2):e0247856. doi: 10.1371/journal.pone.0247856.
3. Ruban A, Stoenchev K, Ashrafian H, Teare J. Current treatments for obesity. *Clin Med (Lond)*. 2019;**19**(3):205-212. doi: 10.7861/clinmedicine.19-3-205.
4. Ammori BJ, Skarulis MC, Soran H, Syed AA, Eledrisi M, Malik RA. Medical and surgical management of obesity and diabetes: what's new? *Diabet Med*. 2020;**37**(2):203-210. doi: 10.1111/dme.14215.
5. Albaugh VL, Abumrad NN. Surgical treatment of obesity. *F1000Res*. 2018;**7**:F1000 Faculty Rev-617. doi: 10.12688/f1000research.13515.1.
6. Hua Y, Lou YX, Li C, Sun JY, Sun W, Kong XQ. Clinical outcomes of bariatric surgery - Updated evidence. *Obes Res Clin Pract*. 2022;**16**(1):1-9. doi: 10.1016/j.orcp.2021.11.004.
7. Georgiadou D, Sergentanis TN, Nixon A, Diamantis T, Tsigris C, Psaltopoulou T. Efficacy and safety of laparoscopic mini gastric bypass. A systematic review. *Surg Obes Relat Dis*. 2014;**10**(5):984-91. doi: 10.1016/j.soard.2014.02.009.
8. Kermansaravi M, Shahmiri SS, DavarpanahJazi AH, Valizadeh R, Berardi G, Vitiello A, Musella M, Carbajo M. One Anastomosis/Mini-Gastric Bypass (OAGB/MGB) as Revisional Surgery Following Primary Restrictive Bariatric Procedures: a Systematic Review and Meta-Analysis. *Obes Surg*. 2021;**31**(1):370-383. doi: 10.1007/s11695-020-05079-x.
9. De Luca M, Tie T, Ooi G, Higa K, Himpens J, Carbajo MA, Mahawar K, Shikora S, Brown WA. Mini Gastric Bypass-One Anastomosis Gastric Bypass (MGB-OAGB)-IFSO Position Statement. *Obes Surg*. 2018;**28**(5):1188-1206. doi: 10.1007/s11695-018-3182-3.
10. Brown WA, Ooi G, Higa K, Himpens J, Torres A; IFSO-appointed task force reviewing the literature on SADI-S/OADS. Single Anastomosis Duodenal-Ileal Bypass with Sleeve Gastrectomy/One Anastomosis Duodenal Switch (SADI-S/OADS) IFSO Position Statement. *Obes Surg*. 2018;**28**(5):1207-1216. doi: 10.1007/s11695-018-3201-4.
11. Felsenreich DM, Langer FB, Bichler C, Eichelter J, Jedamzik J, Gachabayov M, Mairinger M, Richwien P, Prager G. Surgical Technique of Diverted One-Anastomosis Gastric Bypass. *Surg Technol Int*. 2021;**39**:107-112. doi: 10.52198/21.STI.39.GS1485.
12. Ribeiro R, Guerra A, Viveiros, O. (2018). Diverted MGB: A New Procedure. In: Deitel M. (eds) Essentials of Mini-One Anastomosis Gastric Bypass. 327-342. 2018. https://comum.rcaap.pt/bitstream/10400.26/33378/1/Diverted%20MGB.pdf [Accessed on July 27, 2023]
13. Peterli R, Wölnerhanssen BK, Peters T, Vetter D, Kröll D, Borbély Y, Schultes B, Beglinger C, Drewe J, Schiesser M, Nett P, Bueter M. Effect of Laparoscopic Sleeve Gastrectomy vs Laparoscopic Roux-en-Y Gastric Bypass on Weight Loss in Patients With Morbid Obesity: The SM-BOSS Randomized Clinical Trial. *JAMA*. 2018;**319**(3):255-265. doi: 10.1001/jama.2017.20897.
14. Han Y, Jia Y, Wang H, Cao L, Zhao Y. Comparative analysis of weight loss and resolution of comorbidities between laparoscopic sleeve gastrectomy and Roux-en-Y gastric bypass: A systematic review and meta-analysis based on 18 studies. *Int J Surg*. 2020;76:101-110. doi: 10.1016/j.ijsu.2020.02.035.
15. Ibrahim MY, Elshennawy AS, Wassef ATS, Salah A, Hassan AM, Mikhail S. One Anastomosis Gastric Bypass Versus Long Biliopancreatic Limb Roux-en-Y Gastric Bypass. *Obes Surg*. 2022;**32**(3):779-785. doi: 10.1007/s11695-021-05874-0.
16. Mahawar KK, Kumar P, Carr WR, Jennings N, Schroeder N, Balupuri S, Small PK. Current status of mini-gastric bypass. *J Minim Access Surg*. 2016;**12**(4):305-10. doi: 10.4103/0972-9941.181352.
17. Billeter AT, Fischer L, Wekerle AL, Senft J, Müller-Stich B. Malabsorption as a Therapeutic Approach in Bariatric Surgery. *Viszeralmedizin*. 2014;**30**(3):198-204. doi: 10.1159/000363480.
18. Musella M, Berardi G, Velotti N, Schiavone V, Manetti C, Vitiello A. Safety and efficacy of OAGB/MGB during the learning curve: setting a benchmark in a bariatric center of excellence. *Updates Surg*. 2023;**75**(1):169-174. doi: 10.1007/s13304-022-01380-9.
19. Parmar CD, Zakeri R, Mahawar K. A Systematic Review of One Anastomosis/Mini Gastric Bypass as a Metabolic Operation for Patients with Body Mass Index ≤ 35 kg/m^2. *Obes Surg*. 2020;**30**(2):725-735. doi: 10.1007/s11695-019-04293-6.
20. Noun R, Slim R, Chakhtoura G, Gharios J, Chouillard E, Tohmé-Noun C. Resectional One Anastomosis Gastric Bypass/Mini Gastric Bypass as a Novel Option for Revision of Restrictive Procedures: Preliminary Results. *J Obes*. 2018;**2018**:4049136. doi: 10.1155/2018/4049136.
21. Mittal T, Ahuja A, Dey, A. Goel R. Bariatric and Metabolic Surgery in India: Where Do We Stand? *Indian J Surg*. 2022; **84**: 1-8. doi:10.1007/s12262-021-03149-7.
22. Moorehead MK, Ardelt-Gattinger E, Lechner H, Oria HE. The validation of the Moorehead-Ardelt Quality of

Life Questionnaire II. *Obes Surg*. 2003;**13**(5):684-92. doi: 10.1381/096089203322509237.

23. Poulsen L, Simonsen N, Klassen AF, Cano S, Rose M, Juhl CB, Stoving RK, Andries A, Sorensen JA. Comparison of the Moorehead-Ardelt quality of life questionnaire and the BODY-Q in Danish patients undergoing weight loss and body contouring surgery. *Clin Obes*. 2020;**10**(2):e12351. doi: 10.1111/cob.12351.
24. Myers JA, Clifford JC, Sarker S, Primeau M, Doninger GL, Shayani V. Quality of life after laparoscopic adjustable gastric banding using the Baros and Moorehead-Ardelt Quality of Life Questionnaire II. *JSLS*. 2006;**10**(4):414-20. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3015739/pdf/jsls-10-4-414.pdf
25. Oria HE, Moorehead MK. Bariatric analysis and reporting outcome system (BAROS). *Obes Surg*. 1998;**8**(5):487-99. doi: 10.1381/096089298765554043.
26. Favretti F, Cadiere GB, Segato G, Busetto L, Loffredo A, Vertruyen M, Enzi G, Caniato D, De Marchi F, Lise M. Bariatric analysis and reporting outcome system (BAROS) applied to laparoscopic gastric banding patients. *Obes Surg*. 1998;**8**(5):500-4. doi: 10.1381/096089298765554052.
27. Costa JM, Soares JB. Bariatric Analysis and Reporting Outcome System (BAROS): Toward the Uniform Assessment of Bariatric Surgery Outcomes. *GE Port J Gastroenterol*. 2015;**22**(3):85-86. doi: 10.1016/j.jpge.2015.04.004.
28. Stahl JM, Malhotra S. Obesity Surgery Indications and Contraindications. [Updated 2022 Jul 25]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK513285/ [Accessed July 28, 2023]
29. Kasama K, Seki Y. [Bariatric surgery--indication and contraindication]. *Nihon Rinsho*. 2013;**71**(2):335-40. Japanese. https://pubmed.ncbi.nlm.nih.gov/23631217/
30. Sjöholm K, Anveden A, Peltonen M, Jacobson P, Romeo S, Svensson PA, Sjöström L, Carlsson LM. Evaluation of current eligibility criteria for bariatric surgery: diabetes prevention and risk factor changes in the Swedish obese subjects (SOS) study. *Diabetes Care*. 2013;**36**(5):1335-40. doi: 10.2337/dc12-1395.
31. Gafoor AM, Reynu R, Kirubakaran M, Vimal Kumar V, Nik Ritza NM, Tikfun G, Haron A. Patient and procedure selection for bariatric and metabolic surgery in Malaysia- The Malaysian Consensus. *Med J Malaysia*. 2021;**76**(2):229-232. https://www.e-mjm.org/2021/v76n2/bariatric-surgery.pdf
32. Kirkil C, Aygen E, Korkmaz MF, Bozan MB. Quality of Life After Laparoscopic Sleeve Gastrectomy Using Baros System. *Arq Bras Cir Dig*. 2018;**31**(3):e1385. doi: 10.1590/0102-672020180001e1385.
33. Singh A, Ahmad R, Sinha S, Haq MA, Narwaria M, Haque M, Kumar S, Sanghani N. One Anastomosis Gastric Bypass Surgery: Consequences Over Ascorbic Acid, Cobalamin, Calciferol, and Calcium. *Bangladesh Journal of Medical Science*. 2023, **22**(3), 695–708. doi:10.3329/bjms.v22i3.66965.
34. Versteegden DPA, Van Himbeeck MJJ, Nienhuijs SW. Improvement in quality of life after bariatric surgery: sleeve versus bypass. *Surg Obes Relat Dis*. 2018;**14**(2):170-174. doi: 10.1016/j.soard.2017.10.008.
35. Vetrovsky T, Fortova T, Conesa-Ros E, Steffl M, Heczkova J, Belohlavek J, Courel-Ibáñez J. Increased Cardiopulmonary Fitness Is Associated with a Greater Reduction in Depression among People Who Underwent Bariatric Surgery. *Int J Environ Res Public Health*. 2021;**18**(5):2508. doi: 10.3390/ijerph18052508.
36. Browning MG, Franco RL, Herrick JE, Arrowood JA, Evans RK. Assessment of Cardiopulmonary Responses to Treadmill Walking Following Gastric Bypass Surgery. *Obes Surg*. 2017;**27**(1):96-101. doi: 10.1007/s11695-016-2259-0.
37. Nedeljkovic-Arsenovic O, Banovic M, Radenkovic D, Rancic N, Polovina S, Micic D, Nedeljkovic I. The Amount of Weight Loss Six Months after Bariatric Surgery: It Makes a Difference. *Obes Facts*. 2019;**12**(3):281-290. doi: 10.1159/000499387.
38. Parmar CD, Gan J, Stier C, Dong Z, Chiappetta S, El-Kadre L, Bashah MM, Wang C, Sakran N. One Anastomosis/Mini Gastric Bypass (OAGB-MGB) as revisional bariatric surgery after failed primary adjustable gastric band (LAGB) and sleeve gastrectomy (SG): A systematic review of 1075 patients. *Int J Surg*. 2020; **81**: 32-38. doi: 10.1016/j.ijsu.2020.07.007
39. Park JY, Song D, Kim YJ. Causes and outcomes of revisional bariatric surgery: initial experience at a single center. *Ann Surg Treat Res*. 2014;**86**(6):295-301. Doi: 10.4174/astr.2014.86.6.295.
40. Uhe I, Douissard J, Podetta M, Chevallay M, Toso C, Jung MK, Meyer J. Roux-en-Y gastric bypass, sleeve gastrectomy, or one-anastomosis gastric bypass? A systematic review and meta-analysis of randomized controlled trials. *Obesity (Silver Spring)*. 2022;**30**(3):614-627. doi: 10.1002/oby.23338.
41. Li X, Hu X, Fu C, Han L, Xie M, Ouyang S. Efficacy and Safety of One Anastomosis Gastric Bypass Versus Roux-en-Y Gastric Bypass for Obesity: a Meta-analysis and Systematic Review. *Obes Surg*. 2023;**33**(2):611-622. doi: 10.1007/s11695-022-06401-5.
42. Malinowski SS. Nutritional and metabolic complications of bariatric surgery. *Am J Med Sci*. 2006;**331**(4):219-25. doi: 10.1097/00000441-200604000-00009.
43. Sherf-Dagan S, Biton R, Ribeiro R, Kessler Y, Raziel A, Rossoni C, Kais H, Bragança R, Santos Z, Goitein

D, Viveiros O, Graham Y, Mahawar K, Sakran N, Ben-Porat T. Nutritional and Lifestyle Behaviors Reported Following One Anastomosis Gastric Bypass Based on a Multicenter Study. *Nutrients*. 2023;**15**(6):1515. doi: 10.3390/nu15061515.

44. Berardi G, Vitiello A, Abu-Abeid A, Schiavone V, Franzese A, Velotti N, Musella M. Micronutrients Deficiencies in Candidates of Bariatric Surgery: Results from a Single Institution over a 1-Year Period. *Obes Surg*. 2023;**33**(1):212-218. doi: 10.1007/s11695-022-06355-8.
45. Zarshenas N, Tapsell LC, Batterham M, Neale EP, Talbot ML. Changes in Anthropometric Measures, Nutritional Indices, and Gastrointestinal Symptoms Following One Anastomosis Gastric Bypass (OAGB) Compared with Roux-en-y Gastric Bypass (RYGB). *Obes Surg*. 2021;**31**(6):2619-2631. doi: 10.1007/s11695-021-05284-2.
46. Ganipisetti VM, Naha S. Bariatric Surgery Malnutrition Complications. [Updated 2023 May 19]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK592383/ [Accessed July 28, 2023]
47. O'Kane M, Parretti HM, Pinkney J, Welbourn R, Hughes CA, Mok J, Walker N, Thomas D, Devin J, Coulman KD, Pinnock G, Batterham RL, Mahawar KK, Sharma M, Blakemore AI, McMillan I, Barth JH. British Obesity and Metabolic Surgery Society Guidelines on perioperative and postoperative biochemical monitoring and micronutrient replacement for patients undergoing bariatric surgery-2020 update. *Obes Rev*. 2020;**21**(11):e13087. doi: 10.1111/obr.13087.
48. Quilliot D, Coupaye M, Ciangura C, Czernichow S, Sallé A, Gaborit B, Alligier M, Nguyen-Thi PL, Dargent J, Msika S, Brunaud L. Recommendations for nutritional care after bariatric surgery: Recommendations for best practice and SOFFCO-MM/AFERO/SFNCM/ expert consensus. *J Visc Surg*. 2021;**158**(1):51-61. doi: 10.1016/j.jviscsurg.2020.10.013.
49. Tapper EB, Lai M. Weight loss results in significant improvements in quality of life for patients with nonalcoholic fatty liver disease: A prospective cohort study. *Hepatology*. 2016;**63**(4):1184-9. doi: 10.1002/hep.28416.
50. Vallis M. Quality of life and psychological well-being in obesity management: improving the odds of success by managing distress. *Int J Clin Pract*. 2016;**70**(3):196-205. doi: 10.1111/ijcp.12765.
51. Ryder JR, Edwards NM, Gupta R, Khoury J, Jenkins TM, Bout-Tabaku S, Michalsky MP, Harmon CM, Inge TH, Kelly AS. Changes in Functional Mobility and Musculoskeletal Pain After Bariatric Surgery in Teens With Severe Obesity: Teen-Longitudinal Assessment of Bariatric Surgery (LABS) Study. *JAMA Pediatr*. 2016;**170**(9):871-7. doi: 10.1001/jamapediatrics.2016.1196.
52. King WC, Hinerman AS, White GE. A 7-Year Study of the Durability of Improvements in Pain, Physical Function, and Work Productivity After Roux-en-Y Gastric Bypass and Sleeve Gastrectomy. *JAMA Netw Open*. 2022;**5**(9):e2231593. doi: 10.1001/jamanetworkopen.2022.31593.
53. Halliday TA, Sundqvist J, Hultin M, Walldén J. Post-operative nausea and vomiting in bariatric surgery patients: an observational study. *Acta Anaesthesiol Scand*. 2017; **61**(5):471-479. doi: 10.1111/aas.12884.
54. Groene P, Eisenlohr J, Zeuzem C, Dudok S, Karcz K, Hofmann-Kiefer K. Postoperative nausea and vomiting in bariatric surgery in comparison to non-bariatric gastric surgery. *Wideochir Inne Tech Maloinwazyjne*. 2019; **14**(1):90-95. doi: 10.5114/wiitm.2018.77629.
55. Pandolfino JE, Krishnamoorthy B, Lee TJ. Gastrointestinal complications of obesity surgery. *MedGenMed*. 2004: **6**(2):15. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1395777/?report=printable
56. Ruiz-Tovar J, Zubiaga L, Muñoz JL, Llavero C. Incidence of postoperative nausea and vomiting after laparoscopic sleeve gastrectomy with staple line reinforcement with oversewing and staple line inversion vs. buttressing material: A randomized clinical trial. *Int J Surg*. 2018;**59**:75-79. doi: 10.1016/j.ijsu.2018.09.010.
57. Felsenreich DM, Langer FB, Eichelter J, Jedamzik J, Gensthaler L, Nixdorf L, Gachabayov M, Rojas A, Vock N, Zach ML, Prager G. Bariatric Surgery-How Much Malabsorption Do We Need?-A Review of Various Limb Lengths in Different Gastric Bypass Procedures. *J Clin Med*. 2021;**10**(4):674. doi: 10.3390/jcm10040674.
58. Azim S, Kashyap SR. Bariatric Surgery: Pathophysiology and Outcomes. *Endocrinol Metab Clin North Am*. 2016;**45**(4):905-921. doi: 10.1016/j.ecl.2016.06.011.
59. Heneghan HM, Yimcharoen P, Brethauer SA, Kroh M, Chand B. Influence of pouch and stoma size on weight loss after gastric bypass. *Surg Obes Relat Dis*. 2012; **8**(4):408-15. doi: 10.1016/j.soard.2011.09.010.
60. Hussain A, Van den Bossche M, Kerrigan DD, Alhamdani A, Parmar C, Javed S, Harper C, Darrien J, Singhal R, Yeluri S, Vasas P, Balchandra S, El-Hasani S. Retrospective cohort study of 925 OAGB procedures. The UK MGB/OAGB collaborative group. *Int J Surg*. 2019; **69**: 13-18. doi:10.1016/j.ijsu.2019.07.003