Section: Surgery

Original Research Article

EFFECT OF LAPAROSCOPIC MINI-GASTRIC BYPASS SURGERY ON BLOOD SUGAR, HbA1c IN OBESE PATIENTS WITH TYPE 2 DIABETES MELLITUS

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ABSTRACT

Background: Aim of our study was to evaluate the effect of laparoscopic mini-gastric bypass surgery on blood sugar and HbA1c levels in obese patients with type 2 diabetes mellitus.

Material and Methods: The present prospective and observational study was conducted over 40 obese patients with BMI more than 32.5 kg/ m2 with Type 2 Diabetes Mellitus undergoing Laparoscopic MGB at various Zonal and Command hospitals of AFMS during the period from May 2021 to August 2024.

Results: BMI and excess weight loss% (EWL%) were found statistically significant during follow up (p=0.001) after 3 and 6 months. Biochemical parameters (Se glucose levels, HbA1c, Se insulin) were reduced significantly over the period (p=0.001).

Conclusion: A return to normal levels of glucose, HbA1c, insulin and ideal weight are attained with LMGB in majority of diabetic patients of obesity. The quality of life improves in all patients. There remain some conflicts to be further cleared like long-term (>than 5 years) effects on weight reduction and T2DM remission, late complications. In conclusion, clinical trials in future with prospective design are still required to show its utility and formulate guidelines for LMGB.

Keywords: Mini gastric bypass, Type 2 diabetes mellitus, morbid obesity, HbA1c, Serum Insulin, weight loss surgery.

INTRODUCTION

Obesity and Type 2 diabetes mellitus(T2DM) prevalence is increasing rapidly worldwide, particularly in developing nations. The International Diabetes Federation reported in 2015 about 450 million diagnosed diabetic patients globally. 85.0–95.0% of the patients had T2DM, and 75.0% were from low-income countries.[1] In a previous study evaluated that the total number of obese persons were 671 million all over the world2.13.0% of them resided in the USA and 15.0% in China and India. Obesity is found as one of the major factors contributing to diabetes, stroke, coronary heart diseases, cancer, and sleep apnea.[3] It is well known that uncontrolled and unregulated obesity can result in significant health problems by decreasing life expectancy and affects quality of life. The obesity and co-morbid diabetes is imposing a significant global burden on our individual health, families, societies, and entire health systems.[4] Studies showed that weight loss, even when modest, can reduce the incidence of T2DM in patients with impaired tolerance of glucose, improve blood glucose control and other cardiovascular factors of risk in patients suffering with type 2 diabetes, while marked weight loss can even lead to resolution/ remission of diabetes.[5]

Innovations by surgeons have achieved remarkable developments in bariatric surgery, which is now the only effective long-term treatment modality for morbid obesity,[6] T2DM in morbid obesity, and

possibly, T2DM in non-morbid obesity.[7] Over the past 2decades, bariatric surgery has gained an increasing importance in the management of T2DM in obese patients. Generally, the surgical procedures for morbid obesity can be categorized as: solely restrictive [laparoscopic adjustable gastric banding (LAGB) and its variants, vertical banded gastroplasty (VGB) and laparoscopic sleeve gastrectomy], mostly restrictive [Roux-en-Y gastric bypass (RYGB)] and mostly malabsorptive [biliopancreatic diversion with duodenal switch (BPDS).[8] Although the standard LRYGB is accepted as the gold standard for bariatric surgery and diabetes remission, it can still carry a higher complication rate for novice surgeons. Laparoscopic mini-gastric bypass is thus reported to be a safer alternative than LRYGB, having similar efficacy in reducing weight and resolving metabolic complications, including diabetes. Both follow-ups of short-term and long-term nature confirmed the durable effect of the above simplified procedure for T2DM in obese or morbidly obese patients.[9] The reports indicate about glycaemic control effect of standard LRYGB on non-obese T2DM. The outcomes of LMGB for non-obese T2DM patients are also found to be outperforming. Both Roux-en-Y gastric bypass (RYGB) and Mini-Gastric Bypass (MGB) act on the principle of restriction and malabsorption, but MGB is simpler with better outcomes, proven in a number of published comparative studies.[10,11] Because of the high complication rate, LRYGB as a technically demanding process for novice surgeons, laparoscopic mini-gastric bypass (LMGB), introduced by Rutledge in 1997, has been reported to be a safe choice to LRYGB, with almost similar efficacy in reducing weight and resolving metabolic complications, including diabetes.[12]

The current treatment modalities for T2DM are ineffective in achieving good glycaemic control in most patients. The American Diabetes Association (ADA) has recommended that the goal of therapy should be a glycosylated haemoglobin (HbA1c) level of < 7%. Levels consistently > 7% warrant re-evaluation and a change in the treatment regimen.[13] Strong proof of improvements in T2DM and impaired tolerance of glucose in obese patients with diabetes (BMI >35 kg/m2) has been reached with all types of bariatric surgery. All-cause mortality has been shown to decrease by 40.0% and disease specific mortality by 92.0% after surgery in long term.[6] Bariatric surgery was recognized as effective treatment alternative for obese patients with T2DM by the ADA as recently as 2009.[14] Even a recent position statement by the International Diabetes Federation has endorsed the use of bariatric surgery as a treatment option for T2DM obese patients uncontrolled by medication.[15]

Several reports of laparoscopic metabolic surgery for T2DM are found in various countries of Asia. However, information related to surgical methods use is most suitable for T2DM in Asia is very less. Unfortunately, no large-scale multi-centre randomized controlled trials are present to evaluate clinical value of LMGB in relation to other techniques. The LMGB indications and outcomes in obese patients are inconclusive till present. So, we aim to study the laparoscopic mini-gastric bypass surgery effect on blood sugar and HbA1c levels in obese patients with type 2 diabetes mellitus.

Aim & Objectives

Aim

To study the Effect of Laparoscopic Mini-Gastric Bypass Surgery on Blood Sugar and HbA1c Levels in Obese Patients with Type 2 Diabetes Mellitus.

Objectives

1. The primary aim of the study was to compare the changes pre-operatively and post-operatively at 03 and 06 months (with respect to reduction/ change/ stoppage in medication) in the following parameters:

a) Blood sugar levels [Fasting (FBG) and Post-prandial (PP)]

b) Glycosylated haemoglobin levels (HbA1c)

2. The secondary end point was to compare BMI status at 03 and 06 months post-operatively and correlate it with the glycaemic control and reduction/ change/ stoppage in medication.

MATERIALS AND METHODS

The present prospective and observational study was conducted over 40 obese patients with BMI more than 32.5 kg/ m2 with Type 2 Diabetes Mellitus undergoing Laparoscopic MGB at various Zonal and Command hospitals of AFMS during the period from May 2021 to August 2024.

Study Area: various Zonal and Command hospitals of AFMS, India

Study Duration: May 2021 to August 2024.

Study design: Hospital based prospective observational study.

Study Sample: Patients with obesity undergoing Laparoscopic MGB.

Study Sample: 40 patients

Sample size estimation: Sample size was calculated using the formula:

$$n \geq \frac{(z1-\alpha/2+z1-\beta)2 + (\sigma12+\sigma22)}{(\mu1-\mu2)2}$$

Where n is desired sample size. z1-α/2, z1-β are the value of corresponding Z variable for maximum allowable error. We have decided to fix the maximum type 1 error to be 0.01 (99% level of confidence for population estimates) and power of 90% (Type 2 error 10%). The corresponding Z values are respectively 2.4 and 1.4 as per the standard Z distribution tables.

For preliminary estimates of σ1, σ2, μ1and μ2, the results of Cohen et al88, was used. The mean pre-operative HbA1c levels were 9.7±1.5 and in the follow up, they were 5.9±0.1. The calculated value of n, using the above formula, came out to be 37.16,

Sample size was approximated to 40 to cater for attrition.

Inclusion Criteria

A BMI > 32.5 kg/ m2 with T2DM undergoing LMGB Surgery

Both male and females

Exclusion Criteria

Patients undergoing Laparoscopic MGB with no type 2 diabetes mellitus.

Patients in whom non-surgical, treatable cause of morbid obesity is present (e.g. Cushing 's Syndrome).

Pregnant patients with any morbid obesity.

Patients with psychiatric illness who were not able to adhere to the protocol.

Screening/ Survey

A total of 53 patients were screened, 7 were rejected to be a part of the study and 6 were not fit according to inclusion criteria and finally 40 patients were found fit according to inclusion criteria.

Data collection

Staff qualification and training

All the above patients were examined by an expert physician and supportive medical team, and then their routine clinical and radiological examinations were done on each patient to the analysis laparoscopic Mini-gastric bypass Surgery.

Quality-control measures to check data completeness and consistency

Local and English language was preferred to ask each patient 's history and it was taken using a confidential questionnaire formulated by the staff members. The questionnaire included questions providing information on personal data, which were next properly encoded. The clinical data given by patients were then complemented with information on diagnosis of the disease, the treatment administered (present and/or past), adverse effects reported.

Outcomes: The primary outcome pre- and post-operative complication of LMGB Surgery. Secondary outcome was BMI status at 03 and 06 months post-operatively.

Method of collection of data

A written consent was taken from all potentially eligible subjects and patients were excluded who did not match with inclusion criteria of the study. A detailed history of the event, and clinical examination was conducted in all patients and noted in a case file. All procedures were performed by GI surgical teams at various zonal and command hospitals.

Preoperative evaluation included blood sampling for usual preoperative laboratory tests, glycosylated haemoglobin also known as HbA1c, fasting plasma glucose called as FPG, 2-hour post prandial glucose (2-h PPG), insulin secretion stimulating tests (fasting plasma insulin, 2-h postprandial insulin, and 2-h postprandial C-peptide, fasting plasma C-peptide), plasma anti-glutamic acid decarboxylase antibody test, abdominal and pelvic computed tomography (CT) scan, chest X-ray and gastroscopy. Pre- and post- operative data at 1-, 3-, and 6-months intervals were compared by FPG, 2-h PPG, HbA1c, and C-peptide level.

Perioperative Workup

In addition to all tests required for the pre-operative workup for obesity and to rule out other causes of T2DM, all the subjects during the course of said study would be evaluated pre-operatively 01 week before and post-operatively at 03 months and 06 months for the following parameters: 1. Metabolic parameters like BMI: were evaluated using a standard (In BODY 3.0 – Body composition analyser), manufactured by Bio space (UK): this machine works on the principle on Bioelectric impedance. 2. Biochemical parameters of blood sugar was evaluated using enzymatic method with automated biochemistry analyser, HbA1c was measured using HPLC method.

Positioning of the patient and Operative techniques

The operations were performed under general anaesthesia.The patients were placed in the supine position with legs open and with 45 degrees inclined position and secured to the surgical table by placing two belts, one on chest area and another on pelvic area. Surgeon stood between the legs, with 1st assistant handling the camera and auxiliary clamp; with the scrub nurse on the right. The catheterization of urinary bladder was not done routinely. Antibiotic prophylaxis was administered on routine basis. The thrombotic events were avoided by making use of graduated compression stockings & intermittent pneumatic boots. Routine placement of disposable orogastric tube (32-Fr) is done.

Pneumoperitoneum and placement of the trocars

Pneumoperitoneum was done by means of direct puncture with visiport trocar in left upper quadrant; near costal margin at level of midclavicular line i.e., Palmer 's point. Initial pressure of 12 mmHg was set, and was maintained till expected pressure of about 12 mmHg was achieved. The surgery was initiated by placing 10 mm permanent trocars for introducing 30 degrees optics or camera kept at mesogastrium between 12-15 cm below xiphoid process & 3 cm to left of midline, and is considered as 1 number trocar. Trocar number 2, of 5 mm, is kept near xiphoid process for use of liver retractor which is mostly a stick or probe held by 2nd assistant staff. The number 3 of 12 mm disposable in nature, was used by surgeon 's left hand, and is placed on right side of patient in an intermediate position, between previous two, 3-5 cm lateral to midline. Number 4 trocar, of 5 mm of permanent nature, was placed along left costal margin in anterior axillary line to 1st assistant staff. The last trocar, 5 number, disposable of 12 mm, was kept adjacent to left costal margin in hemi-clavicular line to right hand manipulation of surgeon.

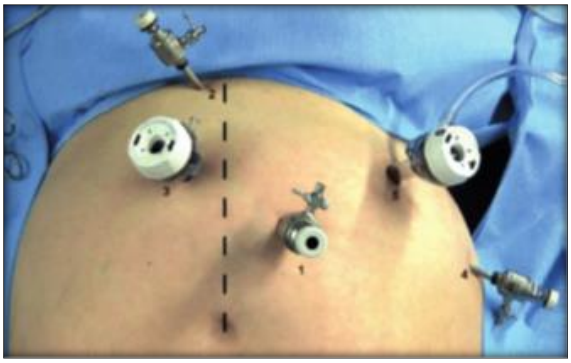

Figure 1: Placement of the trocars

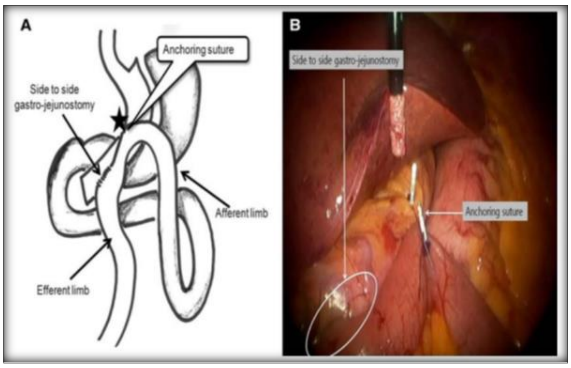

Figure 2A: Diagrammatic illustration of LMGB. An anchoring suture between the mini-gastric tube and the afferent limb was laid to attain an acute angulation at the afferent limb, and simultaneously, to maintain a parallel line between the long gastric tube and the efferent limb.

Figure 2 B: Configuration of the gastrojejunal anastomosis. A steep angulation at the afferent limb was obtained with an anchoring suture adjacent to the anastomosis

Postoperative follow up

The follow up was done 14 days post-operatively on OPD basis and detailed tests regarding the study it was done at 03 and 06 months also. Appropriate medical intervention in form of Insulin administration and/ or oral hypoglycaemic agents were administered depending on the glycaemic control and requirement, in consultation with medical specialist. Any complication of surgery was also noted and dealt accordingly.

Ethical clearance

The research procedure followed was in accordance with approved ethical standards of Zonal and Command hospitals of AFMS India Ethics Committee (Human).

Statistical Analysis

Data was analysed and evaluated using Statistical Package for Social Sciences, version 23, i.e., SPSS Inc., Chicago, IL. Results for continuous variables are shown as mean & ± standard deviation, i.e., SD, whereas results for categorical variables are shown as number (percentage). For comparison of nominal data, chi-square ($\chi 2$) test was used. The paired sample t-test was made use to compare the data on follow up. The level $P < 0.05$ was considered as the cut-off value or significance

RESULTS

- The proposed prospective observational study was carried in total 40 patients with obesity undergoing LMGB. Patients with BMI > 32.5 kg/ m2 with T2DM undergoing LMGB Surgery were part of study.
- Mean age of studied patients was 42.2±9.3 years where females were in majority (57.5%).
- Mean weight, height and BMI of the total studied patients and it was found as 93.8±11.8 kg, 1.5±0.2 meters and 38.5±4.3 kg/m2 respectively
- Mean Duration of Surgery (in minutes) and mean hospital stay (in days) was 93.9±18.35 and 4.3±1.4 respectively
- BMI and excess weight loss% (EWL%) were found statistically significant during follow up (p=0.001) after 3 and 6 months
- Bio chemical parameters were reduced significantly over the period of time of follow up (p=0.001)

The table 1 shows pre and post operatively bio-chemical parameters changes and it was seen that all the parameters were significantly reduced over the period of time of follow up (p=0.001).

Table 1: Bio chemical parameters changes over the time Figure 17A: Fasting Blood Sugar (mg/dl) changes over time

Parameters	Pre-operatively	After 3 months	After 6 months	p-value*
Fasting Blood Sugar (mg/dl)	185.1 ± 21.7	144.9 ± 28.8	113.9 ± 18.4	<0.001
2 hour post-prandial (mg/dl)	379.8 ± 87.6	214.0 ± 50.6	164.8 ± 27.2	<0.001
HbA1c%	9.2 ± 1.1	7.3 ± 0.8	5.9 ± 0.7	<0.001

**Anova test*

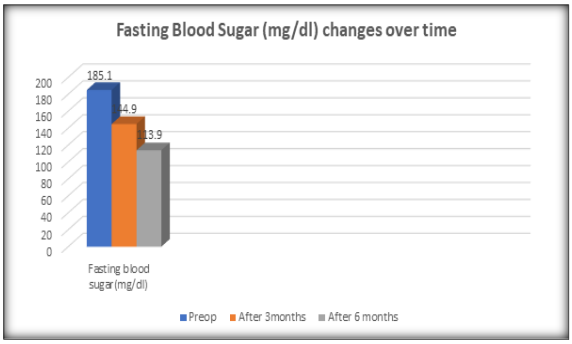

Figure 3A: Fasting Blood Sugar (mg/dl) changes over time

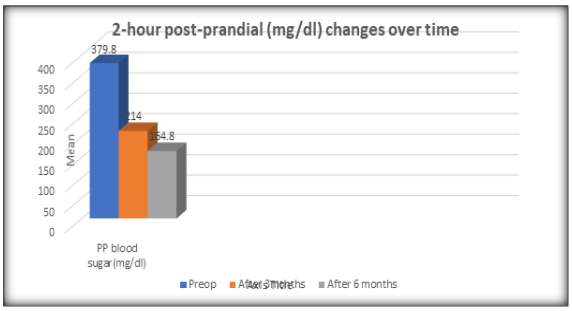

Figure 3B: 2-hour post-prandial (mg/dl) changes over time

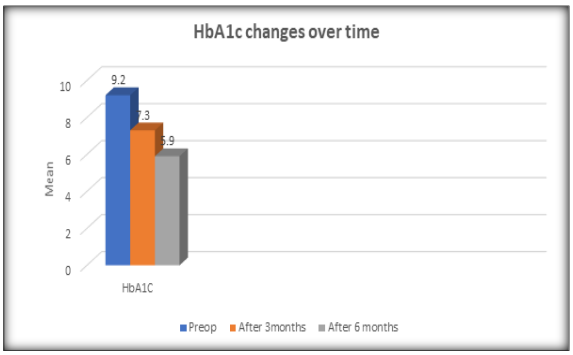

Figure 3C: HbA1c changes over time

The table 2 shows the metabolic parameters changes over the time and it was found that BMI and excess weight loss (EWL)% were found statistically significant during follow up (p=0.001).

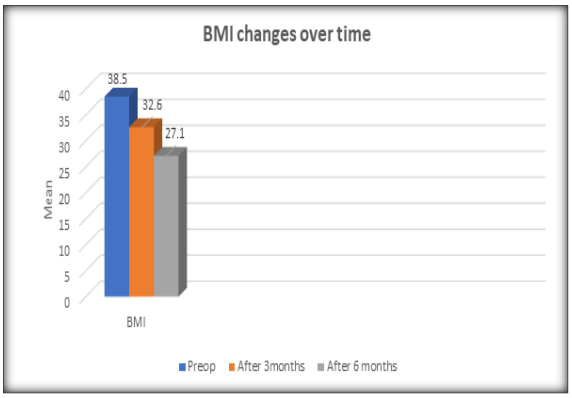

Figure 4A: BMI changes over the time

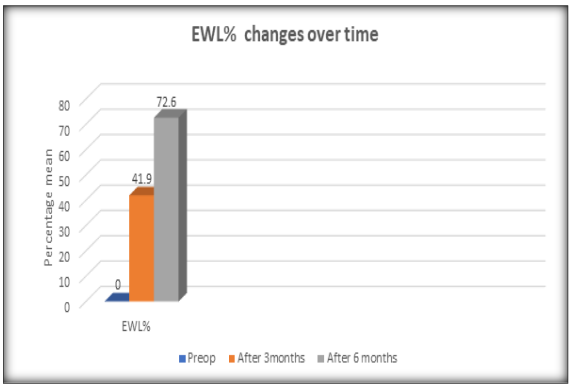

Figure 4B: EWL% changes over the time

Table 2: Metabolic parameters changes over the time

Parameters	Pre-operatively	After 3 months	After 6 months	p-value
BMI (kg/m2)	38.5 ± 4.3	32.6 ± 4.6	27.1 ± 3 .1	<0.001
EWL%	-	41.9 ± 5.2	72.6 ± 6.1	<0.001

DISCUSSIONS

The proposed prospective observational study was carried in total 40 patients with obesity undergoing Laparoscopic MGB at Zonal hospital of AFMS. A BMI > 32.5 kg/ m2 with T2DM undergoing LMGB Surgery were part of this study.

The World Health Organization (WHO) estimates that between 2000 and 2030, World population will experience a 37% growth, and number of diabetics will increase 114%.[16] However, although many novel pharmaceutical agents have been introduced for treatment and remission of diabetes, long-term success results of blood glucose control through lifestyle changes and conventional medical therapy are still discouraging. Newer bariatric surgery techniques are the only effective method for longer-term treatment of morbid obesity, in case of T2D in morbid or non-morbid obese patients, and plausibly, in T2D in patients of non-obesity. Since it is accepted that RYGB is gold standard in bariatric surgery & in remission of diabetes; it may have higher rate of complications when performed by novice surgeons. Therefore, OAGB/MGB is a safe alternative to RYGB, with similar success in weight reduction and resolution of metabolic complications, including T2D.[17]

Since appearance, prevalence of LMGB has been low and many controversies rose. Complications like marginal ulcers, Barrett oesophagus, chronic alkaline reflux, anastomosis leakage requiring revisional surgery and stenosis made it less popular.

However, LMGB also has many benefits, like one anastomosis, no internal herniation and lower risk of anastomotic leakage, shorter operative time (OT), shorter learning curve, and ease of reversibility.[11] Unfortunately, there are no large scale multicentre randomized controlled trials to assess clinical values of LMGB in relation with other different techniques and indications and results of LMGB in patients with obesity are still indecisive. Therefore, we conducted the above study to observe and see the effect of LMGB surgery on blood sugar and HbA1c levels in type 2 diabetes mellitus patients with obesity.

Metabolic parameters changes over the time

In the above study mean BMI was 38.5±4.3 kg/m2 preoperatively which was reduced to 32.6±4.6 kg/m2 after 3 months of surgery and further reduced to 27.1±3.1 kg/m2 after six months of surgery and the association during follow up was found as statistically significant (p<.0.001). Also, the excessive weight loss was reduced significantly after three and six months of surgery and the mean reduction at 6 months was 72.6±6.1%. Our findings were echoing with Hamed MKF et al,[18] who reported that there was statistically significant difference in percentage of excess weight loss (EWL %) and percentage of diabetes remission favouring the mini-gastric bypass group) which was evident by the mean value of FBG, 2HPP glucose and HbA1c at the postoperative follow-up visits at 1-month, 3-month, 6-month, 9-month and 12-months.

Rajan R et al,[19] in their study on metabolic surgery in super-obese Malaysians reported the mean percentage of total body weight loss (%TBWL) at 1 year was statistically significant (P< 0.01) and shows an increase from 15.2% ± 6.8% to 25.1% ± 7.1% and 34.2% ± 8.8% at 3-, 6- and 12-month interval respectively following surgery. Likewise, mean BMI, BMI change and percentage excess BMI loss (%EBMIL); all indicates significant improvement after 1 year. As per Kular KS et al,[20] pre-op BMI of 43.2 kg/m2 was maintained by participants at 26.2 kg/m2 after 6 years; percentage EWL (% EWL) was found 48.0% at 6 months; followed by 85.0% after the end of 1 year. Lee WJ et al,[21] studies throw light on effect of LMGB for Type II Diabetes Mellitus and reports that preoperative mean BMI was 39.7 kg/m2 which was decreased to 27.0, then 26.1, 26.9, and then 28.0 kg/m2 at 1 year, 2 yr, 3 yr, and 5 years after surgery, with percentage to changes in BMI of 31.9%, 34.2%, 32.2%, and 29.5% at 1year, 2year, 3year, and 5 years. An Asian study on effects of LMGB on Weight Loss and Biomarker Measures in Morbidly Obese Patients conducted by Najm AH22 found that mean values of each of body weight (119.6 ± 17.8 kg) & BMI (44.26 ± 4.025 kg/m2) which significantly decreased after 2 months of MGB (p<0.001) in comparison with that of preoperative means (135.36 ± 18.4 kg & 51.7 ± 7.1 kg/m2 respectively). This study reports a decline in mean ± SD of these measures after 6 months of this process (88.1 ± 15.4 kg & 31.10 ± 1.72 kg/m2 respectively) with significant difference (P<0.001). The age group of young people showed a faster weight loss rate compared with group of older people. It may be because of their high BMR and easy adaptability to new things.

Bio chemical parameters changes overtime

In our study, all the parameters reduced significantly postoperatively after 3rd and 6th months (p<0.001). They are Fasting Blood Sugar (mg/dl), 2 hour post-prandial (mg/dl) and HbA1c%. Likewise, Najm AH et al,[22] in their study reports that after 2 months of MGB, the mean FBG (87 ± 10.5 mg/dl) was substantially declining (p=0.001) in comparison with pre-operative mean value (106.4 ± 15.2 mg/dl). Coskun H et al12reports that glucose levels in blood decreased to 100±28.8 g/dL at postoperative twelfth month. Additionally, mean HbA1c was found as 5.79±1.3% & 6.70±1.6% at sixth- and twelfth-month follow-up, respectively. Kim Z et al9 clinical results reveal marked decline in HbA1c and tendency to decline in FPG and 2-h PPG by postoperatively in 1, 3, and 6 months. HbA1c decreased to 6.7%, FPG to 144 mg/dl, and 2-h PPG to 203 mg/dl, at 6 months after the operation (p<0.001). As per Rajan R et al19 which supports our findings by reporting substantial improvement in diabetic status of the study population. Both mean HbA1c and FBS decreased from pre-operative values of 7.0% ± 1.0% & 7.0 ± 0.9 mmol/L to 5.6% ± 0.4% & 5.0 ± 0.6 mmol/L, respectively; at twelve months after surgery (P<0.01). Around 93.0% of our patients who were earlier on some type of anti-diabetic treatment; no longer needed medication at 12 months after surgery.

Aulestia SN et al,[23] study of preoperative metabolic data; patients would seem to have less severe ailment given the preoperative values of FBG and HbA1: 193.6 ± 52.9 mg/dl and 8.4 ± 1% which declined significantly to 78.8 ± 7.6 mg/dl & 6.1 ± 0.2% after follow-up (p<0.001). Thus, it becomes important to highlight a series from India which showcases more cases—128 patients that go through OAGB/MGB—82 mildly obese females, with BMI preoperative of 33.4 ± 3.3 kg/m2, Type II Diabetes patients with mean on-set age of disease of 6.5 years, and elevated values of HbA1c of 10.7 ± 1.5% (8.4 ± 1%), & blood glucose beyond 200 mg/dl.

The MGB was in beginning greeted with suspicion because of the MGB ‘s relation with ―old Mason ‘s loop gastric bypass and because of lack of review of literature on reflux of bile. The authors interrogated criticism of MGB and instead spurred on by failures of band, and RNY adopted MGB. In all published data till date, n number of MGBs have been done worldwide over last sixteen years. The reported incidence of reflux of bile has been significantly found low.[20]

As per Jammu GS et al,[24] study; significant reduction in use of oral anti-diabetic medicine and insulin was followed in MGB. The patients taking many medicines for T2D shifted to single agent. The

nine patients who still had oral anti-diabetic medicines were the one with long history of diabetes of uncontrolled nature and whose C-peptide levels were found very low.

It was evident that LMGB was most effective process for reducing serum glucose levels in comparison to laparoscopic adjustable gastric banding & LSG. Thus, gastric bypass process should be chosen firstly in diabetic morbidly patients having obesity if they are found eligible for the surgical treatment.[12] This meta-investigation of Quan Y et al,[11] thoroughly evaluated the safety of MGB and contrasted it & gastric banding, sleeve gastrostomy and gastric bypass. MGB appears to be efficient in reducing weight and increasing T2DM with low morbidity and mortality.

Among different types of procedures of bariatric, it is known LRYGB is technically demanding, long & difficult procedure, with long learning curve. Thus, morbidity & mortality of LRYGB can be difficult if performed by novice surgeons. Thus, LMGB as an optional procedure has some benefits, including single and easy gastrojejunal anastomosis by drawing long mini-gastric tube down, rather pulling small intestine with thick and short mesenteries up to short gastric pouch, as seen in LRYGB. In relation to LMGB, LRYGB carried more than 3 times risk of major complications was shown.[12]

Various results were and being published in context to outcome of surgery depending upon type of process and approach; are it one or two stages; further, the final decision relies on surgeon having taken all factors into consideration which includes input by multidisciplinary team and the patients themselves. Importantly, the process of choice should be able to give significant weight loss after sustainable period, show improvement in associated co-morbidities and present low rate of morbidity and mortality.

CONCLUSION

In our study, mean age of studied patients was 42.2±9.3 in which females were in majority (57.5%). Mean weight, height and BMI of total studied patients was found as 94.1±11.8 kg, 1.5±0.2 meters and 38.5±4.3 kg/m2 respectively. Mean Duration of Surgery and hospital stay was 93.9±18.35 and 4.3±1.4 respectively. BMI and excess weight loss% (EWL%) were found statistically significant during 3 and 6 months follow up (p=0.001). Biochemical parameters were reduced substantially over a period of time (p=0.001).

We would like to conclude that the most important parameter in selection of a bariatric procedure remains safety and efficacy in reaching both weight loss and remission of metabolic result of obesity. In comparison with LSG, LAGB and LRYGB, LMGB was at least not inferior in weight reduction and T2DM remission & at the same time had few complications. T2D in obese people is no longer an uncontrollable ailment. A return to normal levels of glucose, HbA1c, insulin and ideal weight are attained with LMGB in majority of diabetic patients of obesity. The quality of life improves in all patients. There remain some conflicts to be further cleared like long-term (> 5 years) effects on weight reduction and T2DM remission; late complications. In conclusion, clinical trials in future with prospective design are still required to show its utility and formulate guidelines for LMGB.

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