- Not all excess weight is lost
- Major Undertaking with risk of complications including mortality

1. Extensive patient counselling which involves discussion of all the three surgical options with special emphasis on the risks of each procedure.
2. Careful evaluation of the patient's expectations is essential. Some patients want a better weight loss and don't mind the risks associated with a sleeve or a bypass while others are not prepared to take those risks and want a gastric banding.
3. Factors like Hiatus hernia and reflux oesophagitis.
4. Assessment of patient's compliance in future.
5. A frank discussion of the surgeon's experience of a particular procedure.

Gastric banding is suitable only in a limited number of patients who are well informed and understand the working of a band. They understand the need for some self-discipline, need for a monthly follow-up initially, need for band adjustments. Weight loss after gastric banding is inferior to sleeve and bypass. So patient's expectations should be defined. They should understand that weight loss after a gastric banding is modest and can be variable.

Decision between sleeve gastrectomy and gastric bypass rests on the following factors:-

1. Patient's preference
2. Surgeon's preference
3. Duration of Diabetes Mellitus
4. Presence of reflux symptoms and hiatus hernia.

Bariatric surgery is an extremely effective means of sustained weight loss. The impact on co-morbidities is impressive with remission/ improvement of Type II diabetes, sleep apnea, hypertension, PCOD in majority of the patients. Extensive patient counselling; both by a surgeon as well as a nutritionist, detailed clinical evaluation and a well trained team are the keys to a successful result.

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Surgical Cure for Type II Diabetes -From Bariatric Surgery to Metabolic Surgery

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***Abstract**: India is fast becoming the diabetes capital of the world. A significant proportion of these patients are overweight or obese. Bariatric surgery leads to a remarkable impact on type 2 diabetes mellitus. Remission of the disease occurs in 60-80% of the patients undergoing surgery i.e. these patients are off any anti-diabetic medication while maintaining normoglycemia. The impact occurs early in the post-operative course before any significant weight loss has occurred. Thus, factors other than weight loss are responsible. The possible mechanisms include role of gut hormones like GLP1, faster gastric emptying, decrease in inflammatory status and improvement in insulin resistance. Due to this remarkable impact of bariatric surgery on diabetes mellitus among the morbidly obese population, there is a lot of research going on in the field of metabolic surgery where standard bariatric surgery procedures or some similar novel procedures are being used in diabetic patients with class I obesity or normal BMI patients in hope of remission/resolution of diabetes. Surgical cure of diabetes is possible in near future and it may become the standard of care in a select group of diabetic patients.*

Diabetes is a global epidemic affecting about 250 million people worldwide. Being overweight increases the chances of becoming diabetic ten-fold. For those who are obese, the risk of becoming diabetic increases 30-fold. The twin problem of diabetes and obesity in India is increasing at an exponential rate. India leads the world with the largest number of diabetic subjects, earning the dubious distinction of being termed the "diabetes capital of the world". According to the Diabetes Atlas 2009 published by the International Diabetes Federation, around 50.8 million people in India are affected with diabetes and this number is expected to rise to 87 million by 2030. The so-called "Asian Indian Phenotype" refers to certain unique clinical and biochemical abnormalities in Indians like increased insulin resistance, greater abdominal adiposity i.e. higher waist circumference despite lower body mass index, lower adiponectin and higher C-reactive protein levels. This phenotype makes Asian Indians more prone to diabetes and premature coronary artery disease.

Type II diabetes is considered a progressive and relentless disease with progressive beta cell failure. The progressive nature requires ongoing assessment of metabolic control and usually leads to an intensification of therapy with increasing doses of hypoglycemic agents, including insulin. Furthermore, obesity appears to be the engine driving the epidemic of diabetes and it is most unfortunate that many of these therapeutic agents are associated with weight gain. Thus, the search for cure and/or better control of T2DM is an ongoing process.

In a landmark article entitled "Who would have thought it? An operation proves to be most effective therapy for adult onset diabetes", Pories et al highlighted the drastic impact of surgery on Type 2 diabetes Mellitus. Since then the conventional modality of treatment is being challenged by growing number of surgeons. Published research is providing further evidence that surgery can be more efficient than either standard or intensive medical treatment alone.

It has been well-documented that bariatric procedures such as sleeve gastrectomy, Roux en y gastric bypass and billiopancreatic diversion promote evident and sustained weight loss, with clear improvements in hyperglycemia, dyslipidemia, hypertension and associated co morbidities, as well as mortality in morbidly obese patients (BMI>35.0 kg/m2). The impact on type 2 diabetes is particularly impressive with 70-80% patients

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achieving remission or improvement. More importantly, this positive impact on diabetes occurs in the early postoperative period when substantial weight loss has not occurred. It is believed that various gut hormones play an important role in resolution of diabetes after bariatric surgery. The role of the bypass of foregut has been considered one of the important reasons for this. The bariatric operations like the gastric bypass and the duodenal switch involve a variable degree of bypass of the duodenum and jejunum. One of the theories about the cause of Type-2 diabetes mellitus has been the excessive stimulation of foregut by food leading to overproduction of Glucose-dependent Insulinotropic Peptide (GIP) and consequent hyperinsulinemia and insulin-resistance. Bypass of the foregut excludes it from the food and thus there is no stimulation of the K-cells in the duodenum responsible for secreting GIP. Moreover, the undigested food is presented early to the distal ileum. This early presentation of chyme to ileum leads to stimulation of L-cells and an increased secretion of Glucagon like peptide-1 (GLP-1).

Published long term results of bariatric surgery procedures involving bypass of the duodenum report an 85 to 98 percent cure rate of T2DM in obese patients. The clinical resolution of T2DM is defined as independence of all anti-diabetic medications and maintaining a HbA1c less than 6.0. The gastric bypass resolves T2DM in 84-86% of patients and the duodenal switch in over 95%. More interesting than this statistic is the fact that the T2DM resolution is evident within days to weeks after the surgery and long before experiencing any meaningful weight loss.

The mechanism of glycemic improvement has been a subject of interest and there are many studies that have tried to explain this phenomenon. As mentioned earlier, role of the bypass of foregut has been considered one of the important reasons put forward to explain this dramatic post-operative resolution of T2DM. Dr. Francesco Rubino's pioneering rodent experiments clearly demonstrate a key role for the nutrient excluded proximal small intestine in the resolution of T2DM. The gastric restrictive element of the bariatric operation has no role in glycemic control in this model. This has been elegantly demonstrated by Rubino et al in their study on non-obese diabetic rats where a gastrojejunal bypass (GJB) was done with an intact gastric volume. There was a marked improvement in the fasting plasma glucose levels in all the rats that underwent GJB.

The bariatric operations like the gastric bypass and the duodenal switch involve a variable degree of bypass of the duodenum and jejunum. One of the theories about the causes of Type-2 diabetes mellitus has been the excessive stimulation of foregut by food leading to overproduction of Glucose-dependent Insulinotropic Peptide (GIP) and consequent hyperinsulinemia and insulin-resistance. Bypass of the foregut excludes it from the food and thus there is no stimulation of the K-cells in the duodenum responsible for secreting GIP. The lower level of GIP causes upregulation of the GIP receptors of b cells and improvement in insulin resistance. Thus there is a restoration of the glucose homeostasis. Moreover, the undigested food is presented early to the distal ileum. This early presentation of chyme to ileum leads to stimulation of L-cells and an increased secretion of Glucagon like peptide-1 (GLP-1). This peptide has a potent glucose dependent action on the b cells of pancreas. This results in increased insulin secretion and improvement of diabetes. In the stomach GLP-1 has an inhibitory effect on gastric motility thus delaying the gastric emptying. This may also contribute to the improvement of diabetes, as less insulin will be required due to slower availability of food in the intestines.

Thus, potential mechanisms responsible for positive impact on diabetes following bariatric surgery include immediate post operative starvation followed by rapid weight loss, expedited delivery of nutrients to distal intestine (Ileal brake, hindgut hypothesis) and foregut hypothesis (duodenal exclusion). Physical shortcuts enhancing rapid delivery of nutrients to distal small intestine increase secretion of GLP-1, Peptide YY and Oxyntomodulin for L cells and are implicated in reduction of food intake and gastrointestinal motility and improve glucose homeostasis. Evidence for this theory is derived in part from Jejuno-ileal bypass (JIB), with GLP-1 levels elevated over 10 fold and improved glucose homeostasis. Despite positive evidence for the lower intestinal hypothesis, recently published rodent experiments by Francesco Rubino clearly demonstrate that nutrient excluded duodenum and proximal jejunum play a major role in resolution of T2DM independent of the hindgut hypothesis. Rubino experiments provide conclusive evidence that T2DM could be eliminated or restored solely based on the absence or presence, respectively, of nutrient flow through the proximal intestine, with a fixed degree of nutrient shortcutting to the distal intestine.

The impressive results of bariatric surgery on type 2 diabetes mellitus in morbidly obese population has led to consideration of surgery as a treatment option for diabetes in diabetic patients with BMI <35.0 kg/m. Rubino et al and DePaula et al have popularized the concept of metabolic surgery for treatment of Type 2 DM in non-obese patients (BMI<35 kg/m^2) with duodeno-jejunal bypass and ileal interposition + sleeve gastrectomy respectively and have shown good results. Laparoscopic Sleeve Gastrectomy (LSG) alone has been proposed by several experts as a reasonable option for metabolic surgery, being safer and simple. It has shown resolution of type 2 diabetes mellitus in 60-80% of morbidly obese patients and significant improvement in remaining. It involves removing 80–90% of the stomach, leaving behind only a sleeve of it. There is no clear opinion on mechanism of resolution of T2DM after LSG. Possible mechanisms include calorie restriction and decreased Ghrelin production as a result of removal of the gastric fundus, which is a major source of Ghrelin. However, some studies have shown alteration of distal gut hormones like GLP-1 that have an impact on insulin sensitivity and beta cell function might be responsible.

Laparoscopic sleeve gastrectomy **(**LSG), a restrictive bariatric operation, may be used to induce weight loss in moderately obese diabetic patients. LSG is a simpler and safer operation than other bariatric operations like gastric bypass and duodenal switch (BPD-DS). LSG has a favorable impact on Type II Diabetes. Our own experience with this procedure shows that more than 80% patients are cured of diabetes. Han et al reported marked improvement in the comorbidities, which were present in 50 out of 60 patients who underwent LSG.[4] Diabetes resolved in all the 8 diabetic patients, hypertension resolved in 92.9% and improved in the remaining patients. There are few reported studies till date, on effect of LSG on DM with BMI < 35 kg/m^2. These have shown resolution rates of 50% - 88% with significant decrease in HbA1C after 1 year.

CONCLUSIONS

Diabetes is a major public health problem with debilitating complications. It is difficult to achieve a smooth euglycemic state with the conventional treatment like diet, exercise, oral hypoglycemic agents and insulin. With tighter control of the diabetes, a reduction of the complications has been reported. Impressive improvement in diabetic status of patients undergoing bariatric surgery has stimulated interest in surgery as a potential cure for type 2 diabetes (NIDDM). India is the diabetic capital of the world. A lot of these patients are obese. A safe surgical procedure with a very low rate of complications is required if surgery for cure of diabetes is considered. At present metabolic surgery that is surgery for cure of Type II Diabetes mellitus can be considered for moderately obese diabetics in well- designed studies. Only after the safety of these procedures has been proved beyond

doubt, should they be offered to non-obese diabetics. Laparoscopic Sleeve gastrectomy is a reasonable option for metabolic surgery. More complex procedures have a higher rate of complications and should be done only as a part of controlled clinical trials.

Metabolic surgery is an exciting area, which is likely to have far reaching consequences on the treatment of Type II Diabetes Mellitus in future. However a scientific and cautious approach is required from the surgical community to avoid any mishaps, which could lead to premature death of this extremely promising treatment option.

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Bariatric Surgery for Treatment of Obstructive Sleep Apnea

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***Abstract**: Morbidly obese patients have a high prevalence of obstructive sleep apnea (OSA). Besides excellent weight loss, Bariatric surgery leads to significant impact on OSA. A majority of patients are off the continuous positive pressure (CPAP) machine within few weeks of the surgery. Reduction of fat around the neck leads to decrease in pressure on upper airways and breathing apparatus. Bariatric surgery also leads to improvement of inflammatory status which also is a factor leading to improvement in OSA after surgery. Bariatric surgery should be offered as treatment for OSA in patients with a body mass index (BMI) > 35 Kg/m^2. It can also be considered in patients with BMI between 30-35 Kg/m^2 and OSA.*

INTRODUCTION

Obstructive sleep apnea (OSA) is a disorder of sleep. Itis due to repetitive collapse of the upper airways leading to snoring, fragmented sleep, hypoxemia, hypercapnea, swings in intrathoracic pressure and increased sympathetic activity. Clinically the patient has excessive daytime sleepiness,snoring andpauses and choking spells in breathing during sleep. It is estimated that 2% of middle aged women and 4% of middle aged men suffer from OSA[1]. Prevalence of sleep apnoea increases with increasing body mass index (BMI).A ten percent increase in weight predicts a 6-fold increase in the odds of developing moderate-to-severe OSA[2]. Its incidence in morbidly obese patients has been reported between 38% and 93% and is more frequent in men[3]. As screening for OSA before BS is increasing, more and more patients of OSA are being detected; nevertheless, many researchers believe that it is still a under reported problem[4].Several severe health-related issues have been associated with OSA including those of premature death, sudden death from cardiac causes, traffic accidents, hypertension, ischaemic heart diseases, stroke, type II diabetes, increased neck circumference and visceral adiposity.

Clinical diagnosis of OSA is difficult. Diagnostic tools like the Epworth Sleepiness Score, the Maintenance of Wakefulness Test, the Berlin Questionnaire, Wisconsin Sleep Questionnaire, the STOP and STOP-BANG Questionnaire are commonly used for screening of OSA in bariatric patients. However, accuracy of these questionnaires is inconsistent[5]. The standard method of diagnosing OSA is via polysomnography (PSG). PSG test is done in sleep laboratory and patients need to stay overnight in the laboratory. PSG calculate the number of apnoea (complete cessation of airflow) and hypopnea (50% to 90% decrease in airflow and at least a 4% drop in oxygen saturation for >10 seconds) episodes in each hour of sleep. "Apnea hypopnea index" (AHI) or "respiratory disturbance index" (RDI) are two commonly used parameters to classify the degree of sleep disturbances. In general, an AHI of less than 5 is normal, 5-15 is mild sleep apnoea, >15 is moderate sleep apnoea, and >=30 is severe sleep apnoea[6]. Due to the high prevalence of OSA in bariatric patients and the risk of serious post operative consequences with undiagnosed OSA following bariatric surgery, many centres advocate routine use of pre operative PSG in all prospective bariatric surgery patients[7]. In general, most of the bariatric programmes are not conducting routine preoperative PSG prior to bariatric surgery. It is more of a tailored approach, only the patients with preoperative symptoms of OSA are referred for PSG[8]

BARIATRIC SURGERY AS A TREATMENT OPTION FOR OBSTRUCTIVE SLEEP APNEA

Medical therapy in the form of Positive Airway Pressure (PAP) is the primary treatment modality for OSA. Surgery is an option only in selected group of patients. The primary objectives of surgery in OSA are to increase the airway size and decrease the airway resistance, thereby reducing the work of breathing. The surgical proceduresfor OSA may be site-specific techniques like nasal surgery (septoplasty, turbinectomy), Uvulo-palato-pharyngoplasty or surgery on the base of the tongue. Surgical therapy may also involve upper airway reconstruction like maxilla mandibularadvancement, tracheostomy or non-airwaysurgery like bariatric surgery [9]. Bariatric surgery involves surgery on the gastro intestinal tract in order to create caloric restriction and sometimes mal-absorption in order to induce weight loss. The commonly performed bariatric procedures are adjustable gastric banding (AGB), Roux-en-Y gastric bypass (RYGB), sleeve gastrectomy (SG), and bilio-pancreatic diversion (BPD). These procedures are either restrictive, mal absorptive or both and are done laparoscopically in majority of the patients.

Presently, bariatric surgery is recommended in OSA patients with body mass index (BMI) more than 35kg/m^2 [10,11].

In majority of the patients,bariatric surgery improves or resolves OSA and the other parameters of sleep quality[12-15].

MECHANISM OF OSA IMPROVEMENT FOLLOWING BS

Improvement in OSA following bariatric surgery are due to weight

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