

Bariatric surgery and diabetes

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ABSTRACT

Obesity is a relatively new and serious world-wide epidemic. Obesity is a stronger predictor in mortality than either poverty or smoking, and obesity is also now more prevalent than malnutrition. The prevalence of obesity continues to increase, ironically, the rate of increase of obesity is highest amongst the morbidly obese. Obesity is the result of many factors resulting in concert, including poor dietary habits, reduced physical activity and genetic predisposition. With the rapid increase in obesity there has been a pronounced increase in obesity-related metabolic disorders including type 2 diabetes, hyperlipidemia, hypertension and many others. These co-morbidities are responsible for more than 2.5 million deaths, worldwide. The loss of life expectancy due to obesity is profound. In comparison to a normal weight individual Caucasian, a 25-year-old morbidly obese man has a 22% reduction in the expected remaining life span, representing an approximate loss of 12 years of life.

Key Words: Bariatric surgery, obesity, diabetes

Obesity is a relatively new and serious world-wide epidemic. Obesity is a stronger predictor in mortality than either poverty or smoking, and obesity is also now more prevalent than malnutrition. The prevalence of obesity continues to increase, ironically, the rate of increase of obesity is highest amongst the morbidly obese. Obesity is the result of many factors resulting in concert, including poor dietary habits, reduced physical activity and genetic predisposition. With the rapid increase in obesity there has been a pronounced increase in obesity-related metabolic disorders including type 2 diabetes, hyperlipidemia, hypertension and many others. These co-morbidities are responsible for more than 2.5 million deaths, worldwide. The loss of life expectancy due to obesity is profound. In comparison to a normal weight individual Caucasian, a 25-year-old morbidly obese man has a 22% reduction in the expected remaining life span, representing an approximate loss of 12 years of life.^[1]

Unfortunately, diet therapy with and without supporting

organizations is relatively ineffective in treating obesity in the long term. There are currently no truly effective pharmaceutical agents available to treat obesity, especially the morbidly obese. The first report of diabetes remission after gastrointestinal operations date back to the first half of the twentieth century with publications of anecdotal, but consistent, observations of improvement after gastric resection for peptic ulcer or gastric cancer. Bariatric surgery confirmed this observation.^[2]

Being overweight is defined as having a Body Mass Index (BMI) > 25 to 29.9 kg/m² while obesity is defined as BMI > 30 kg/m². There are many indications for bariatric surgery. However, in our center, bariatric surgery is only offered to patients < 45 years with a BMI > 35 kg/m² plus type 2 diabetes or sleep apnoea.

Bariatric surgery has progressed along three generic lines: restrictive, restrictive/malabsorptive and purely malabsorptive. Surgical procedures include gastric banding (including adjustable and non-adjustable bands), gastric bypass, (principally Roux-En Y variations), gastroplasty (gastric sleeve), biliopancreatic diversion or duodenal switch. Operative mortality – mortality at 30 or less days – as a generalization increases with the complexity of the operation. It is around 0.1% for purely restricted procedures, 0.5% in patients undergoing gastric bypass procedures and

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1.1% in patients undergoing biliopancreatic diversion or duodenal switch procedures. Gastric bypass is a safe and effective procedure in the proper hands. Laparoscopic gastric bypass procedures seem to be similarly effective with similar mortality rates with reduction in morbidity, particularly for the most common complications, wound infections and wound hernias. Restrictive procedures have significantly less morbidity and mortality.^[3]

Bariatric surgery provides the most effective means of weight loss and sustained weight control for the morbidly obese. The objective of bariatric surgery is to decrease excess body weight and so reduce related co-morbidities. Given the marked improvement of resolution associated nature co-morbidities in obesity surgery, the benefit of the properly selected patient with significant co-morbidities would seem substantial when compared with the risk. In general the effect on co-morbidities of obesity benefits most from greater weight loss.^[3]

It has been suggested that diabetes resolves as a result of the massive weight loss after surgery. This explanation is too simple: there are clearly other mechanisms at work. For instance, almost immediately after gastric by-pass, ahead of any significant weight loss, diabetes is resolved. Furthermore, bypassing the duodenum and jejunum in lean animals with diabetes has the same positive effects on blood glucose as in obese animals with diabetes: this improvement in glycemic control is not due to weight loss. These experimental findings have been confirmed in non-obese diabetic humans who had duodenal-jejunal bypass carried out. After about a year, these patients had normal HbA1c levels without significant weight loss. Similar results have been described with a non-surgical intervention in which a tube was deployed endoscopically within the duodenum to mimic a duodenal jejunal bypass.^[4]

There are other experimental studies that support the concept that surgical control of diabetes occurs as a consequence of the rearrangement of gastrointestinal anatomy. Although the exact mechanism remains a mystery, recent clinical investigations suggest changes in gastrointestinal hormones play a dominant role. Other obvious factors include calorie restriction and change in dietary composition. The fat content of the adipocyte, may also be relevant. Reduction in the fat content of the adipocyte reduces inflammatory mediators and improves adipokines, which affect the regulation of insulin sensitivity. Other operations have been proposed to provide even better metabolic solutions. These include resection of the omentum to reduce the intra-abdominal fat mass which is considered to be crucial to the development of metabolic disorders, particularly the metabolic syndrome.

The loss of this fat mass is associated with multiple metabolic, adipokinetic and inflammatory changes which include improved insulin sensitivity and glucose disposal, reduced free fatty acid flux, increased adiponectin levels and decreased interleukin 6, tumor necrosis factor alpha and high sensitive C-reactive protein levels. Metabolic effects from bypass foregut include altered responses of ghrelin, glucagon like peptide, and peptide_{YY3-36}. These gut hormones are involved in glucose regulation and appetite control.^[5]

When defined as the ability to discontinue all diabetes related medications and maintain blood glucose levels with normal range, there is strong evidence for improvement in type 2 diabetes and impaired glucose tolerance across all surgery types. There is a difference in diabetes outcomes according to the categories of operative procedure. With respect to diabetic resolution there is gradational effect from around 90% from biliopancreatic diversion or duodenal to just over 84% for gastric bypass to around 72% for gastric sleeve and 48% for gastric banding. Other co-morbidities are also significantly improved by weight loss. The outcome categories of hyperlipidemia, hypercholesterolemia and hypertriglyceridemia are significantly improved across all surgical procedures. The percentage of patients improved is around 70%. Again the maximum improvements in hyperlipidemia occur with biliopancreatic diversion or duodenal switch procedures and with gastric bypass. Even after accounting for the pain and anxiety of surgery, inconveniences of dietary restrictions and possible complications including the operation, quality of life should improve for the majority of bariatric surgery patients. Weight loss in excess of 45 kg, relief of fatal co-morbidity diseases, improved appearance, improved social and economic opportunities should markedly enhance quality of life. In the majority of patients there is an improvement in the perception of well-being, social function, body self imaging and self-confidence. Time spent in recreational and physical activities also increases after bariatric surgery.^[6]

It is suggested that bariatric surgery should be offered preferentially to obese type 2 diabetic patients early in the disease process. Patients with less "severe" type 2 diabetes with shorter duration of type 2 diabetes have better weight loss from surgery and the magnitude of weight loss appears to increase the likelihood of diabetes resolution. In addition, it has been shown that younger patients' bariatric surgery is more likely to lead to resolution of their type 2 diabetes. The likelihood of complete resolution is increased in patients with type 2 diabetes of short duration (less than 5 years) and less "severe" disease (non-insulin requiring type 2 diabetes). This would suggest that beta cell deterioration is reversible at least early in the course of

the disease and that this may be the best time to intervene before permanent damage occurs. It also seems sensible to suggest that patients with more severe disease are at a higher operative risk, thus earlier surgical intervention should decrease major complications. In addition, medical management is not as effective in achieving glycemic control nor is it likely alter the cause of the disease, therefore younger patients with less severe disease stand to gain more from surgery by circumventing years of progressive, possibly debilitating disease.^[7]

Bariatric surgery should never be regarded as “a quick fix”. A recent review in England and Wales indicated that improvements are required in a lot of centers across the whole of the care pathway. Obviously the surgery is enormously important but equally important are the selection processes that go into deciding who best to provide with bariatric surgery. In addition, pre-surgery patients should be given appropriate dietary, nursing, medical and possibly psychological input. Pre-surgery it is very important that the patients have time to reflect on their choices and have their opportunities to ask further questions about the risks and benefits. The patient needs to be well informed, motivated, willing to participate in long-term care, change dietary patterns and embrace a revised lifestyle. Post-surgery these patients require regular follow-up with again appropriate input from dietetic, nursing and medical staff plus often psychology.^[6]

Change occurs rapidly after bariatric surgery, and medical evaluation and biochemical testing at follow-up visits should be tailored to patients’ profile of obesity associated co-morbidities. Tests to monitor control of diabetes mellitus, hypertension, dyslipidemia, non-alcoholic steatohepatitis, sleep apnoea and other co-morbidities should be individualised, reassessed and modified. For example, elevated blood glucose concentrations improve even before substantial weight loss. Rapid weight loss can lead to dehydration, fatigue and skin, hair and nail changes. Adequate protein intake is challenging for some patients after bariatric surgery. Because a validated clinical marker for malnutrition has not been identified, assessment of malnutrition can be difficult. Although, serum albumin is not a sensitive marker for malnutrition during acute physical stress, trends in albumin level are important after resolution of the acute stress. Nutritional deficiencies are frequent after malabsorptive types of bariatric surgery. Patients are recommended to take daily multi-vitamins tablets containing minerals and replacement therapy as needed for any deficiency identified during follow-up visits. Iron deficiency is reported in up to one third of patients after bariatric surgery, yet optimal replacement strategies have

yet to be determined. Calcium and vitamin D deficiencies are also common post-operatively. After bariatric surgery, vitamin D deficiency occurs more often in patients who have undergone malabsorptive procedures than those who have restrictive operations. Clinical deficiencies of Vitamin A, E and K are uncommon while fat soluble vitamin deficiencies are common after malabsorptive procedures.

The main incentive for considering bariatric surgery should be to improve health. This can be achieved when the potential benefits of the surgery outweigh the risks for the individual patient. Bariatric surgery is neither completely safe nor unfailingly effective. Some patients will experience major complications or will have a poor weight loss outcome. Discussion of both potential positive and negative outcomes is an important aspect of the assessment of patient considering bariatric surgery. An appropriate patient selection is a very important part of achieving beneficial outcomes. All domains and functions should be elevated including physical health, activity level, nutritional intake and psychiatric status. Healthcare professionals evaluating patients who want to undergo bariatric surgery should work closely with their colleagues, preferably within an integrated multidisciplinary treatment team composed of surgical, medical, nutritionists plus psychiatric or psychology specialists. Careful screening and follow-up by a multi-disciplinary team is very important in selecting appropriate patients and improving outcomes.^[6]

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