The Effects of Bariatric Surgery on Metabolic Conditions

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Capstone Project: The Effects of Bariatric Surgery on Metabolic Conditions

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Chapter One

Introduction

Background/Significance

Across the industrialized world and developing nations, the World Health Organization (WHO) has identified an escalating pandemic of obesity that is becoming one of the most prominent public health concerns at this time. It has been estimated that over 2.3 billion adults throughout the world are overweight and that 700 million are obese (Rajeswaran, Shaikh, & Mohammad, 2013). If the current trend continues, it is estimated that in the United Kingdom by 2050, 60% of males and 50% of females will have a classification of being obese (BMI > 30kg/m$^2$). In Germany, in 2011, one out of every two was given the classification of being overweight and obesity was rated as one in five. Even though France is known for having a lower obesity rate, they are now recognized as having an excess of 10% of individuals being diagnosed with obesity. In developing countries such as Iran, obesity has risen to over 20%.

This discussion is centered on Type 2 diabetes (T2DM) and its amplification in persons that are obese (McNaughton, 2013). Present studies have included various types of surgeries for those with diabesity, and the goal of this paper is to discover which procedure is the most effective in eliminating or halting the progress of obesity-related diabetes.

Limitations in dietary intake and its effect on weight loss, as well as medical treatment with both oral and injection methods and exercise, have been significantly unsuccessful due to undesirable side effects and patient non-compliance (Kennedy, Alberti, & Le Rous, 2012). Due to the rapid expansion of obesity, and the significant morbidities that are linked with obesity; such as cancers, hypertension, cardiovascular diseases, obstructive sleep apnea, diabetes, and osteoarthritis, it is of the utmost importance to search out ways to ameliorate or modify this
condition. The increased incidence of obesity and obesity-related diabetes has led to in-depth studies regarding how to manage weight loss in an effective and maintainable way. In the past, lifestyle modification, regular exercise, diet, and behavior modification have been the pillars of weight loss therapy. Significant and maintainable weight loss has been difficult to achieve and diabetes has become rampant in this cohort with its destruction of organs, tissues, and vasculature (Rajeswaran et al., 2013).

**Theoretical Framework**

![Chronic Care Model Diagram](image)

The framework that was chosen is the Chronic Care Model (CCM) that has been proposed by Wagner et al., (2001). Included in this framework are 1) Organizational support, which addresses the concept of system leadership and the culture of the practice. 2) Clinical information systems offer facts about individual patients as well as provider performance, and
populations in the disease registry. 3) Delivery systems design addresses who is on the practice team and what position they hold, how visits will be organized, and how a plan of care will be processed for follow-up visits. 4) The concept of decision support assists providers to access evidence-based practice recommendations and advises if there is a need for a specialist. This concept also allows for system reminders for patients. 5) Self-management is a vital part of the CCM model. This concept stresses interventions that are patient-centered. It can incorporate psychosocial support, resources for education, and skill-based training. It permits the patient and health care provider to determine problems, establish priorities, and create a feasible plan of action for achieving treatment goals. 6) Community resources are invaluable in the process of helping patients to self-manage their chronic diseases, especially with low-income and elderly patients. The patient must be taught how to use these resources. The patient has to be given enough information and support for them to be ready to set goals and change behaviors. The communication between the healthcare provider and the patient has to be easily accessible so that the patient can discuss any potential life situation that may affect health status, or if the disease has progressed in such a way that it may affect the plan of action. \\

By utilizing these six concepts, it will help them make intelligent and informed decisions that will affect their everyday health issues. This will help the patient to feel more confident of their ability to live with their disease (Fiandt, 2006).

**Purpose Statement**

Bariatric surgery has inserted itself into this gap as the best solution and the most cost-effective intervention for the long-term diabesity “cure.” Is the utilization of bariatric surgery more effective than lifestyle change in reducing the incidence of metabolic conditions such as diabetes mellitus, in obese patients (Azizi, 2013)?
Chapter 2

In the research process, there was utilization of the Clinical Key and Cinahl databases, using the words diabesity, bariatric surgery, diabetes, obesity-related diabetes, and surgical treatment for diabetes. There were 1759 articles using the words bariatric surgery and diabetes, 1987 results for surgical treatment of diabetes, and 495 results for diabesity. All articles included in this paper are peer-reviewed articles that date from within the last five years. The Obesity Guidelines listed by the CDC classify adults by their BMI:

- Healthy weight: 18.5-24.9
- Overweight: 25.0-29.9
- Obesity (begins at 23 for Asians)
  - Class I - 30.0-34.9
  - Class II - 35.0-39.9
  - Class III > 40

Type 2 diabetes is the most prevalent type of diabetes, and the only one that requires surgery for weight loss. The body initially loses sensitivity to insulin. The pancreas tries to make extra insulin to make up for this “insulin resistance,” which in turn affects the production of glucose by the liver. This can result in damage to the organs, tissues, and nerves, which will affect the quality of life if left untreated. This disease is more prevalent among Latinos, Native Americans, Asian/Pacific Island Americans, and African Americans, as well as the elderly (Diabetes.org).

What is bariatric surgery? There are three types of surgical procedures for weight loss: malabsorptive, restrictive, and procedures that could encompass both. The mechanism of
restrictive surgery is that it limits food consumption by forming a slender passage way from the top of the stomach to the bottom. In malabsorptive surgery, most of the small intestine is excluded from the food passageway so that less food, nutrients and fewer calories are absorbed (Cobbold et al., 2012) (Neil, 2013).

The term “diabesity” was created by a group of doctors in the 1970’s who were investigating the link between obesity and T2DM. There continues to be increasing evidence of the relationship between these two conditions, so the term has become an all-encompassing label that also includes the accumulation of abdominal fat which can intensify insulin resistance. This in turn makes a definite autonomous risk factor for the development of diabetes (Colagiuri, 2010).

Chapter 3

Literature Review

Lifestyle modifications that include diet, exercise, and reformation of behavior have long been the pillars to manage diabesity. The ability to follow the strict guidelines of lifestyle change has been proven to be short-lived. The majority of persons with obesity is directly related to decreased activity levels, and increased caloric intake, and very little has been related to genetics.
This imbalance of energy expenditure has allowed medical intervention to be unsuccessful in decreasing the rise of T2DM. Many drugs have been tried, and either pulled from the market for safety reasons or there is poor patient compliance due to excessive side effects with use of these medications. These reasons have left obese patients with few choices (Kennedy, Alberti, & LeRous, 2012).

In a study by Lumeng et al. (2011) showed a significant association between the excessive intake of nutrients and the interruption of cellular mediators that affect inflammation and immunity. This theory describes a prolonged inflammatory response that influences obesity-related diseases. The hormones in the stomach, and small intestine as well as the microbiology of the gastrointestinal-brain axis can be disrupted by bariatric surgery and reduce the comorbidities of obesity.

The significant failure rate of medical treatment, as well as an escalation of obesity and its lethal complications has led to the wide-spread use of bariatric surgery. Bariatric surgery has become the most successful treatment for long-term weight loss, reducing BMI by 10-15 kg/m$^2$ and a weight loss of 30-50kg. This contributes to a possibility of complete remission of diabetes in 50-90% of morbidly obese individuals

Pinkney and Kerrigan, (2004), have established that surgery has a better outcome for resolving metabolic syndrome and improving the quality of life if done in the first few years of diagnosis.

A randomized, unblinded study between the U.S. and Taiwan by (Ikramuddin et al., 2013), was performed with 120 participants from the general population with the criteria of a BMI of 30.0 – 39.9, ages 30 – 67, under medical care for diabetes for greater than six months, and a hemoglobin A1C (HbA1c) greater than 8.0. One group was given lifestyle modification
with a low caloric diet and exercise, the other had exercise and gastric bypass surgery. The project was considered a success if participants reached a combined goal of: systolic blood pressure of less than 130 mmHg, an HbA1C of less than 7.0%, and an LDL of 100mg/dL or less. Nineteen percent of the lifestyle/medically managed patients and 49% of the surgery group achieved these goals at the end of one year.

Vetter et al, (2012), did a comparison study between the various types of bariatric surgeries that are available for long-term weight loss (greater than 10 years) and their individual effects on the reduction of Type 2 diabetes. The surgeries available are the adjustable gastric band (AGB), the Roux-en-Y Gastric Bypass (RYGB), vertical sleeve gastrectomy (VSG), and the biliopancreatic diversion with a duodenal switch (BPD-DS). It is noted that the incidence of diabetic remission associated with bariatric surgery is 45-95%, depending upon the procedure and patient compliance.

The results of two studies conducted in the United Kingdom in 2003, were that patients who had diabetes for > 10 years, poor preoperative glycemic control, and a history of insulin use, were less able to attain diabetic remission. Based on multiple meta-analyses, BPD results in the best remission rate, followed by AGB, and RYGB. Intermediately between the two surgeries is the VSG. Evidence is also suggesting that diabetes can recur if the weight is regained.

Leong & Taheri, (2014) suggest that the most effective treatment for obesity related T2DM is bariatric surgery. Both NICE (2006), and the International Diabetes Federation (IDF) have reinforced this standard of care. The induced weight loss and decrease in co-existing morbidities have resulted in a prolonged life expectancy, by lowering cardiovascular risk, and reducing the incidence of obesity-related cancers.
Healthcare professionals need to review medications and exclude or replace medications that may cause a patient to regain weight. For a patient whose diabetes doesn’t totally go into remission after surgery or recurs at a later date, these include many of the oral diabetes agents. Smoking cessation needs to also be a continued part of patient teaching, as a cancer and cardiovascular risk. Providers need to give encouragement in the reduction of alcohol intake, giving sound nutritional advice as to lifestyle changes and emotional eating, checking for underlying psychological disorders, and obstructive sleep apnea. As the BPD and the RYGB are malabsorption surgeries, referral to a dietician would be of great benefit (Leong et al., 2014).

The nurse is a vital part of patient follow up. Due to many patients seeking surgery abroad for various reasons, the primary care nurse will need to teach the patient how to understand and know if there are any surgical complications and what they need to do to address these problems as soon as possible (Kennedy et al., 2012).

According Lumeng et al., (2011), an estimated 64 billion dollars annually is an indirect cost of obesity. Obesity surgery in patients with T2DM might have an initial cost, but will save money in a short amount of time. As an estimation of workload, it would take 5500 surgeons 10 years, doing 400 cases per year, to perform bariatric surgery on the 22 million obese Americans. He believes that the benefits of bariatric surgery, with its attendant weight loss, and advantageous metabolic results greatly exceed those achieved by pharmacologic management and lifestyle modification, and will significantly lessen the comorbidities caused by T2DM and obesity.

In an article review by Cline (2013), it was stated that visceral adiposity was in direct association with insulin resistance due to the abnormal secretion of adipokines by the visceral fat. He mandated that T2DM was a combination of problems: insulin secretion by pancreatic β-
cells, glucose regulation by the liver, and the decrease in insulin sensitivity in the periphery. All these put together result in complications and end-organ injury such as nephropathy, retinopathy, and neuropathy. To compound the problem of weight gain, it is much harder for a diabetic to lose weight because many of the oral antihyperglycemics as well as insulin, cause weight gain.

Highlighted in the article by Pories et al., (2013), not only is T2DM the prime causal agent of amputation, blindness, stroke, cancers, and heart attack, but as a metabolic syndrome, it is linked with deep venous disease, pulmonary emboli, increased risk of infections, osteoarthritis in weight-bearing, asthma, and sleep apnea. Bariatric surgery as an intervention has proven to be the most cost-effective treatment and the only acknowledged cure for T2DM. There are risks attendant to bariatric surgery which include severe dumping syndrome that results in malnutrition, internal hernias, and emotional problems.

In a randomized, prospective trial by Kashyap et al., (2013) it was noted that there was a significant increase in insulin sensitivity and β-cell function in RYGB, which specifically relates to truncal fat that was not identified in the gastric sleeve patients, despite similar weight loss. The RYGB procedure, above all others, is able to reestablish standard glucose tolerance by alleviating the principal metabolic deficiency involved in diabetes pathogenesis.

As the primary goal of weight loss is to improve or modify pre-existing co-morbidities attendant to the disease of diabesity, there must be individualized treatment strategies and a multidisciplinary approach to achieve success in this venture. As bariatric surgery requires a long-term commitment, appropriate psychological evaluation must be done to assess issues with body image, personality, and psychological functioning. The more severely obese patients need to be participants in behavior-modification programs. Lifestyle changes will need to be ingrained for the patient to achieve long term success. Many of these patients have a history of extensive
abuse and psychological disorders that need to be dealt with before any type of surgical intervention can be utilized (Cobbold & Lord, 2012).

Listed in an article by Echauser et al., (2007), there were six habits that were considered essential for optimum health and weight loss after RYGB. These incorporated two snacks and three nutritionally balanced meals daily, the consumption of at least 40-60 oz. of water, while avoiding carbonation, the intake of daily vitamins, at least 7 hours of sleep per night, and 40 minutes of exercise at least four times weekly. Weekly weights were also incorporated as a part of the successful patient’s responsibility so that they would consider their weight loss as their own personal duty.

Limitations

There were a limited number of articles written about the VSG due to the more recent use of this procedure in the realm of bariatric surgery. This would skew the studies into more positive outcomes for the RYGB.

A limitation suggested by Cline (2013), was regarding the need for proper selection of candidates to decrease the recurrence rates in the long term. This would include not only BMI but the resuming of medication as well.

Safety outcomes need to be evaluated by longer-term multicenter studies, to calculate the permanence of the resultant metabolic benefits of all types of bariatric surgery (Kashyap et al., 2013).

It is postulated by Lord et al., 2012, that BMI calculations are not always an accurate portrayal of those needing bariatric surgery. Some individuals can have large stomachs, with thin legs and arms, which causes them to fall below the BMI indicated for surgery. Lord also suggests
that waist measurement also has boundaries, as it does not take a height measurement as part of the calculation.

Cline (2013) suggests that there needs to be additional research for all bariatric procedures for those with a BMI $< 35\text{kg/m}^2$, a better predictor of successful candidate selection, and an investigation into retrospective recurrence rates.

Considered as both a malabsorptive and a restrictive surgery, RYGB is the making of a 20-30 ml gastric pouch that bypasses the stomach, a portion of the small intestine, and creates a Roux extension of up to 150cc. With the combination of surgeries, it is considered the “gold standard” for weight loss. Since it also reestablishes the response of the $\beta$-cells of the pancreas to the hepatic glucose secretion, this is also considered a good procedure for diabetes.

The gastric band is a restrictive surgery which consists of an adjustable silicone band that is put in place at the proximal end of the stomach. This band can be filled with saline and can be adjusted to create a pouch of alterable size, allowing for the pouch to be larger or smaller, dependent upon the desired weight loss. This is also considered a reversible surgery.

During the surgical procedure for the sleeve gastrectomy, 70-80% of the greater curvature of the stomach is removed, and the remaining portion is sutured closed. Since the fundus is primarily responsible for production of ghrelin, which increases appetite, it works by reducing surface area for absorption as well as decreasing the hormonal influence that causes hunger (Rajeswaran et al., 2013).

There is continuing study being done on morbidly obese children with T2DM and while promising results have been shown in this difficult-to-treat age group, the long-term impact on growth and development has yet to be determined (Rajeswaran et al., 2013).
Chapter 4

Conclusion

Bariatric surgery has a unique mechanism by which it can reestablish function of the β-cell in the pancreas, especially in the RYGB, by returning the glucose tolerance level back to normal (Kashyap et al., 2013). The more minimally invasive techniques are better for morbidly obese patients because they will reduce the likelihood of wound infection and pneumonia.

In practice as a primary care provider, bariatric surgery should be recommended as an appropriate alternative to therapeutic lifestyle alone, or with medical treatment, for patients with T2DM who are not able for whatever reasons, to achieve or maintain the recommended treatment targets that would reduce or eliminate pre-existing comorbidities. Surgery should also be seriously considered as an option for people with a BMI of > 35kg/m² without T2DM, or in those patients with a BMI between 30 – 35kg/m² who have demonstrated greatly increased cardiovascular risk factors (Cline, 2013).

Bariatric surgery is considered to be more efficacious if implemented in the early years of diagnosis when it can affect a resolution of metabolic syndrome and improve the quality of life. Therefore early recognition of those patients in whom this intervention will have a therapeutic result is of primary importance. Risks after surgery that the clinician needs to be aware of can include increased depression, mood swings, and substance abuse, so direction to support groups both before and after surgery is vital (Rajeswaran et al., 2013).
It is imperative that constant review of literature be maintained in practice to evaluate the efficacy of treatment on adolescents over the long-term before referral, and for those over age 55.

Reference


Pories, W., Meaffey, J., & Staton, K. (2013). *Surgical Treatment of Type 2 Diabetes Mellitus*. New York, NY: Reed Elsevier


