Bariatric Surgery’s Effect on Risk of Cardiovascular Disease

Kristen Perrella

Sage Graduate School

November 17, 2013
Cardiovascular disease is the number one killer in the United States. Many of the indicators are comorbidities of obesity. One weight-loss option which is often explored as a last resort, is bariatric surgery. Besides the well-studied weight loss after bariatric surgery, comorbidities of cardiovascular disease have been shown to reduce as well. This paper serves to examine the reduction of cardiovascular risk as a result of bariatric surgery.

Heneghan, Meron-Eldar, Bethauer, Schauer, and Young performed a systematic review of research on the topic of cardiovascular outcomes in morbidly obese bariatric patients (2011). Using PubMed and the Cochrane Library, researchers were able to find 52 studies involving 16,867 patients that met their inclusion criteria. The majority of the studies (25) came from the United States, followed by Europe (16), and the rest were from New Zealand, Australia, Canada, South America, and Israel. Researchers included only objective measures of clinical outcome and excluded studies with 50 or fewer patients. The mean age of patients was 42 years old, the population was 78% female, and the mean pre-operative BMI was 49 (Heneghan et al., 2011).

At baseline, the prevalence of dyslipidemia, diabetes, and hypertension was 46%, 28%, and 49%, respectively. The mean follow-up was at 34 months, with follow-ups ranging from 3 to 155 months; in studies with multiple follow-ups, the latest results were used (Heneghan et al., 2011). Post-surgery, the prevalence of dyslipidemia, diabetes, and hypertension decreased 71%, 75%, and 68%, respectively (Heneghan et al., 2011). It was found that biliopancreatic diversion (BPD), a malabsorptive/bypass procedure, as well as the vertical banded gastroplasty (VBG) resulted in the greatest reduction of the three comorbidities in comparison to the Roux-en-Y gastric bypass and laparoscopic gastric banding.

Excess weight loss was found to be an average of 52%, ranging from 16% to 87%. Blood pressure was measured in 42% of the studies; mean systolic blood pressure was reduced
Bariatric Surgery’s Effect on Risk of Cardiovascular Disease

from 139 mmHg at baseline to 124 mmHg at follow-up, and diastolic blood pressure was reduced from 87 mmHg to 77 mmHg (Heneghan et al., 2011). Additionally, a risk factor for cardiovascular disease, high C-reactive protein, was measured in five studies and found to decrease by 61.6% to .7 mg/L (Heneghan et al., 2011). Endothelial function as measured by flow-mediated vasodilation (FMD) of the brachial artery improved, as examined in three studies. Healthy levels are 10% to 15%, and the patients studied had a baseline of 6%, with a significant improvement to 16% post-surgery. Hemoglobin A1C also significantly improved by one-point-five percent. Last, the Framingham risk score, used to determine one’s 10-year risk of coronary heart disease, was examined in three studies. Patients’ score was seen to decrease from 6.3% to 3.8%, meaning that their risk reduced 40% (Heneghan et al., 2011).

The following two studies involved the same patient population, those of the Swedish Obese Subjects Study (SOS), and were the only two studies of the meta-analysis to specifically report on cardiovascular events/mortality. The SOS is an ongoing, non-randomized, controlled study implemented by the Institute of Medicine at the University of Gothenburg, Gothenburg, Sweden. *Bariatric Surgery and Long-term Cardiovascular Events*, studied by Sjostrom et al., involved 2010 patients undergoing bariatric surgery, with 2037 patients receiving usual care and serving as controls (2012). Patients were recruited between 1987 and 2001, and the data were analyzed in 2009, with a mean follow up of 14.7 years. Included in the study, for both the surgery group and the control group, were patients between the ages of 37 and 60 years old, with a BMI of at least 34 in men and at least 38 in women. At baseline, the mean BMI of the surgery group was 42.4 and the mean BMI of the control group was 40.1 (Sjostrom et al., 2011). Of those in the surgery group, 13.2% had gastric bypass performed, 18.7% underwent banding, and the majority, 68.1% underwent the vertical banded gastroplasty (Sjostrom et al., 2011).
The primary end point was mortality, while the secondary endpoints were myocardial infarction and stroke. These data were obtained by cross-referencing the SOS database with the Swedish National Patient Register, the Cause of Death Registry, and the Registry of the Total Population. Information was obtained 2, 10, 15, and 20 years after surgery. Consistent weight loss occurred in the surgery group losing an average of 23%, 17%, 16%, and 18%, while the control group lost a total average of 1% of weight (Sjostrom et al., 2011). Results showed that bariatric surgery was associated with a reduced number of cardiovascular deaths: 28 among the surgery group compared to 49 in the control group. When calculating significance, results were adjusted for variables at baseline conditions in both the surgery and control groups. Among the surgery group, 199 patients experienced a cardiovascular event (myocardial infarction or stroke) while the control group had 234 events (Sjostrom et al., 2011). Overall, bariatric surgery was associated with a reduced fatal myocardial infarction incidence and total myocardial infarction incidence.

In post hoc analysis, it was shown that a higher baseline insulin concentration was associated with a more favorable outcome of bariatric surgery on cardiovascular events. Surprisingly, BMI and other measures did not reveal to be significant factors. On this note, it is fitting that cardiovascular events after bariatric surgery in the same SOS study, including only participants with type 2 diabetes, was studied (Romeo et al., 2012). Generally speaking, individuals with type 2 diabetes are at an increased risk for cardiovascular disease. Of the SOS study participants, the surgery group comprised of 345 individuals and the control group comprised of 262 individuals, all with type 2 diabetes (Romeo et al., 2012). Although no effect was observed on stroke incidence, it did reduce their risk of myocardial infarction. This effect
increased in individuals with higher total cholesterol and triglycerides. Baseline BMI was not found to be related surgery outcome (Romeo et al., 2012).

Methods were the same as Sjostrom et al.’s (2012) study, with the additional inclusion criteria of having type 2 diabetes. Of the surgery group, 227 underwent vertical-banded gastroplasty, 61 underwent gastric banding, and 57 underwent gastric bypass. Ultimately, bariatric surgery was associated with a statistically significant decrease in body weight, blood glucose, serum triglycerides, and both systolic and diastolic blood pressure as well as a statistically significant increase in HDL cholesterol, as compared to the control group (Romeo et al., 2012). At follow-up, 63 first-time cardiovascular events, either stroke or myocardial infarction, whichever happened first, had occurred, while 65 patients of the control group experienced a cardiovascular event (Romeo et al., 2012). After adjustment for baseline characteristics, this was in fact significant. When myocardial infarction and stroke were examined separately, 38 of the surgery group and 43 of the control group experienced a myocardial infarction. This result was significant independent of which surgery was performed. The improvement was even greater in diabetic individuals with a BMI less than 40, which is in line with the American Diabetes Association’s guidelines for bariatric surgery as treatment (as cited by Romeo et al., 2012). Stroke, however, was not associated with a reduced risk after bariatric surgery. This is believed to be due to low statistical power, as only 15% of the SOS participants were type 2 diabetic and thus included in this study (Romeo et al., 2012).

Overall, the SOS study contributed significant findings to the current research on bariatric surgery’s association with cardiovascular events, however it is important to note that the patients were white and Swedish, so the finding might not be generalizable to all Americans. Also, Heghan et al.’s systematic review was 78% female, and therefore might not be
generalizable to males. All studies present results beyond weight loss post-bariatric surgery. While research of the SOS study did not find differences in surgery-type, Heneghan et al. did find that BPD and VBG procedures yielded greater improvements in hypertension, dyslipidemia, and diabetes than the Rouxen-Y gastric bypass and laparoscopic gastric banding (2011).

Though Mahan, Escott-Stump, and Raymond of *Krause’s Nutrition Care Process* (Krause) do not include bariatric surgery in its chapter on cardiovascular disease, it does discuss obesity’s role in one’s risk of cardiovascular disease (2012). BMI and coronary heart disease are positively correlated. Bariatric surgery’s primary purpose is to reduce weight. With that, comes a reduction in adipose tissue. Adipose around the waistline in particular is associated with increased c-reactive protein, a marker of inflammation (Mahan et al, 2012). Even small weight losses of can improve both LDL and HDL cholesterol, levels of c-reactive protein, hypertension, and glucose tolerance (Mahan et al., 2012). Despite this, Krause states that the amount of weight loss and time maintained, as well as the amount of improvement in endothelial function necessary to decrease cardiovascular events is still unknown (Mahan et al., 2012). Sjostrom et al., however, state that “cardiovascular events are the consequence of progressive vascular disease that develops over time. The SOS study has shown that risk factor improvement over 10 years requires sustained and very large (10-40 kg) weight loss that typically cannot be achieved with lifestyle intervention,” (2012). As for endothelial function, Heneghan et al.’s systematic review revealed that results were seen at an average follow-up of 34 months (2011).

These studies help to elucidate options for obese individuals at risk for cardiovascular disease. Still, bariatric surgery is clearly not for everyone, with both risk during surgery and difficult nutrition guidelines post-surgery (small serving sizes and restrictions on food choice due to post-operative changes). There is still a need for further, randomized-controlled studies,
though that could be difficult to achieve depending on one’s attitudes toward bariatric surgery. This research could have an impact on physicians recommending patients for bariatric surgery and physicians clearing patients, especially when they present with cardiovascular disease-related comorbidities.
References


