Impact of bariatric surgery on cardiovascular diseases: Integrative Review

ABSTRACT

Background:A substantial risk factor for cardiovascular disease mortality and morbidity is obesity, which are the leading cause of death internationally. For many years, the first-line treatment for obesity has been lifestyle adjustments, such as diet control, exercise, and behavioral improvements. However, pharmacotherapies and bariatric surgery are taken into consideration when such measures fail. It's interesting to note that abrupt weight loss (like that brought on by bariatric surgery) may actually raise mortality.

Purpose: This study's aim is to educate the public on the effects of bariatric surgery on cardiovascular problems. Therefore, the goals of this study are to thoroughly review the scientific data on the effects of dietary interventions utilizing different diets on weight loss and to address the possibility that cardiovascular illnesses may be impacted by bariatric surgery., to know if there is a Major Adverse Cardiovascular Events reduction following bariatric surgery in clients that are obese and with Cardiovascular Disease.

Methods: This paper used Whittemore&Knafl (2005) process, where it developed a methodological framework for the integrative review process, including defining the issue, formulating the research question, conducting a focused literature search, and utilizing mixed-methods or qualitative data processing strategies to reduce the risk of bias and error.

Result: There were 62,658 individuals from the ten (10) studies that made up this study, of which 23,845 received any kind of bariatric surgery and 38,813 did not. Roux-en- Among the described bariatric procedures were the Y gastric bypass, gastric banding, sleeve gastrectomy, biliopancreatic diversion, vertical banded gastroplasty, and duodenal switch. The follow-up periods for the studies ranged from 3 to 9 years.

Conclusion: Individuals with obesity and CVDs who underwent bariatric surgery had much reduced MACE than those who did not, according to the systematic and thorough investigation. The study showed that bariatric surgery can help persons with obesity and CVDs. An improvement in glucose and lipid metabolism, an improvement in heart function, and an improvement in overall CV outcomes could all have a MACE-lowering effect.

Keywords:*Bariatric surgery, cardiovascular disease*

BACKGROUND

According to epidemiological data, obesity has spread globally and has a major impact on the public's health. It is a significant global contributor to the burden of chronic illness, particularly cardiovascular system illnesses, and it affects practically all ages and socioeconomic groups. According to the World Health Organization, in 2005, there were an estimated 1.6 billion adults who were considered to be overweight (body mass index [BMI] >25 kg/m2) and at least 400 million people who were obese (BMI >30 kg/m2). According to official projections, these figures will continue to rise, and by 2015, 2.3 billion people will be overweight and over 700 million adults will be obese. Traditional weight-loss techniques, including diet, exercise, and behavioral therapy, have shown to be largely ineffective over the long term at treating obesity and the related cardiovascular risk factors, especially when used alone, but have shown some metabolic and cardiovascular benefits when used in combination (Eilat, 2015).However, many significant studies have just recently surfaced, and the long-term implications of bariatric surgery are yet unknown. The paper entitled "Impact of bariatric surgery on cardiovascular diseases" will give us comprehensive Integrative reviews in the medical field to help people comprehend a study issue holistically. Reviews should have a clear structure and thorough methodology to ensure the accuracy of conclusions.

A patient's risk for cardiovascular comorbidities increases if they are obese. This is because obesity has been linked to several cardiovascular illnesses (CVDs), such as venous thromboembolism, heart failure, coronary artery disease, hypertension, and dysrhythmia (Benjamin, 2018). The public's health is seriously at stake due to obesity, and it costs a lot of money. More than 30% of Americans (US) were identified as obese in 2014, which is characterized as having a body mass index (BMI) below 30, with a corresponding projected yearly economic cost of US$150 billion (Kim, 2016). According to studies, bariatric surgery is the most effective and reasonably priced way to manage excessive obesity. Significant weight reduction, higher rates of type 2 diabetes mellitus (DM), hypertension, and hyperlipidemia remission are the outcomes (Gloy, 2013). Prior research has shown that bariatric surgery lowers overall mortality as well as the incidence of myocardial infarction and stroke, even though the existence of the "fat paradox" is still in question (Sjostrom, 2017). According to numerous studies, bariatric surgery significantly lowers ER visits and hospitalizations linked to HF, CAD, and hypertension (Shimada, 2017). However, there is a small but significant risk of perioperative mortality and complications from cardiovascular diseases (CVD), such as dysrhythmia and venous thromboembolism (VTE), associated with bariatric surgery (Vest, 2013). The main objective of the current review paper is to give a basic overview of how bariatric surgery affects different forms of CVD and CVD in general.

Obesity is a complex, chronic disease that increases the risk of developing more than 13 different types of cancer as well as cardiovascular disease.Additionally, a higher mortality risk has been associated with it (Silveira, 2021). Obesity and being overweight, which are more prevalent in women than in men, afflict two-thirds of American women. Obesity increases the incidence of postmenopausal and invasive breast cancers (BC), in addition to increasing the risk of cardiovascular disease in women (Neuhouser, 2015). Women with a normal body mass index (BMI) but considerable body fat have a higher likelihood of postmenopausal invasive BC (Iyengar, 2019). Obesity is a significant risk factor for worse COVID-19 outcomes, including a larger chance of fatality (Chiappetta, 2020). Overweight or obese is a term used to describe a person whose weight is above the limit considered healthy for a certain height. The BMI has long been used as a measure to distinguish between overweight and obesity. This is computed by multiplying the individual's height in square meters by their weight in kilos. The World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) define a normal BMI range for adults as 18.5 to 25, 25 to 30, and 30 or higher, however age must also be taken into account for children (Centers for Disease Control and Prevention). Although BMI is not a perfect index for evaluating the relationship between a person's body weight and health due to its inability to detect body fatness, it is nevertheless regarded as the most helpful screening tool globally.In terms of prevalence, health hazards, and socioeconomic effects, overweight and obesity are developing global problems. In 2016, there were approximately 1.9 billion overweight adults worldwide, or nearly 40% of the world's population (WHO). Over 650 million people, or almost 13% of adults, were obese (WHO). Between 1975 and 2016, the prevalence of obesity nearly tripled globally (WHO). By 2030, roughly half of all adults in the globe will be overweight or obese if this rate is maintained (Dobbs, 2014). In the US, obesity was more common than 30% in 2015–2016, and 7.7% of people had severe obesity (defined as a BMI >40 kg/m2). By 2030, at the latest, 42% of Americans will be overweight, according to estimates (Hales, 2018).

OBJECTIVES

This paper review may contribute to specific progress, the paper entitled "Impact of bariatric surgery to cardiovascular diseases" will give us comprehensive Integrative reviews in the medical field to help people comprehend a study issue holistically. This study aims to enlighten people about the Impact of bariatric surgery on cardiovascular diseases. Obesity is a significant public health issue that, particularly during the climacteric phase, affects more women than men globally. It is critical to identify the nutritional and dietary treatment strategies that work best for women's health. Therefore, the goals and aims of this study are to: I summarize the scientific evidence on the effects of dietary interventions using different diets, on weight loss, body mass index and abdominal obesity reduction, and modification of body composition; and (ii) examine the long-term effects of these diets on the development of cardiovascular disease and cancer. Lastly (iii) to answer the question how bariatric surgery may impact cardiovascular diseases, to know if there is a reduction of Major Adverse Cardiovascular Events (MACE) after bariatric surgery in patients with cardiovascular diseases and obesity.

Methods

This integrated scientific review study draws on epidemiological and clinical investigations, such as cohort studies, systematic reviews, and randomized clinical trials. The writer looked at a systematic review's list of references to see if a particular article may be pertinent and meet our inclusion requirements. Obese clients, or studies that conducted a separate analysis by sex allowed us to extract the data for women who were the populations analyzed. Studies involving teenagers and senior citizens were excluded. Dietary approaches to stop hypertension (DASH), the Mediterranean (MED) diet, the Traditional Brazilian Diet, intermittent fasting (IF), calorie (energy) restriction, food re-education, and low- and very-low-carb diets, also known as very-low-calorie ketogenic diets, were among the interventions that were included (VLCKD). The writer has examined the effects of eating habits like the Mediterranean diet during the follow-up period in the cohort studies. The writer took into account the last 10 years of publishing, and there were no language constraints. The databases PubMed, Scopus, Scielo, and Web of Science have all been included. The writer used a variety of CVDs, including heart failure, coronary heart disease, hypertension, cardiomyopathies, cerebrovascular disease, rheumatic heart disease, and peripheral vascular disease, as one of the objectives was to study CVD and its risk factors. We employed a wide variety of malignancies and neoplasms while discussing cancer.

Design

The best way to identify obesity is not through BMI. However, given its widespread usage in epidemiological and clinical investigations, we have included this metric on the definition of obesity and overweight. When a woman's BMI was greater than 30 kg/m2, we deemed her obese, and when it was greater than 25, we deemed her overweight [12]. Additionally, we took into account abdominal obesity as determined by the waist circumference, waist-hip ratio, and body composition as determined by the percentage of body fat (%BF). The primary outcomes were weight loss or decrease, BMI, WC, or%BF. We also took cancer and cardiovascular risk factors into account. This paper used an integrative review, providing numerous literature reviews from credible sources. This paper used Whittemore&Knafl (2005) process, where it developed a methodological framework for the integrative review process, including defining the issue, formulating the research question, conducting a focused literature search, and utilizing mixed-methods or qualitative data processing strategies to reduce the risk of bias and error. The main purpose of this study is to enlighten people about the Impact of bariatric surgery on cardiovascular diseases. To know if there is a reduction of Major Adverse Cardiovascular Events (MACE) after bariatric surgery in patients with Cardiovascular diseases and obesity.

Search Strategy

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) standard was followed when conducting this review (Page, 2020). The Supplementary Materials contain the PRISMA checklist. The pertinent studies were found by an electronic search of the literature in the Google Scholar, MDPI, PubMed/MEDLINE, ScienceDirect, Cochrane Library, Wiley Online Library, and Springer databases. The following terms were used in the search: "Bariatric Surgery [mesh] OR Metabolic Surgery [mesh]" AND "Cardiovascular disease*[mesh] OR Obesity" AND "Major Adverse Cardiac Event* OR Major Adverse Cardiovascular Event* OR MACE" OR "Bariatric Surgery and Long-term Cardiovascular Events." The evaluation covered all articles from the beginning to January 2023.

The PRISMA FLow Diagram of the literature search discussed the total number of studies used in the integrative review. A total of 176 studies were identified in the literature search, as depicted in the PRISMA flow diagram (Figure 1). Two duplicates were removed, and 16 studies were excluded because of their irrelevance to the aim of this study. Seventy-six records are screened and 21 records are included, following the inclusion criterion. Twenty-one studies were thoroughly reviewed for eligibility. After a thorough review, 11 studies were excluded; thus, 11 studies were included in the review. Ten (10) studies were observational cohort studies and one study was a non-RCT. Subsequently, as can be seen in above figure eleven studies were excluded due to comprehensive screening and the remaining ten studies are included in final records and reports to be included in the review.

Inclusion and Exclusion Criteria

The writer included studies that compared MACE between patients with obesity and CVDs who received bariatric surgery and those who did not. Studies were chosen based on the following inclusion criteria: (1) the primary endpoint was the occurrence of MACE (defined as all-cause mortality or the first occurrence of MI, coronary artery bypass grafting or percutaneous coronary intervention, stroke, or hospitalization for HF); (2) studies comparing surgery and no-surgery groups; (3) the study population was adults with CVDs (for example, ischemic heart disease, hypertension, HF, and obesity), with an exclusion of pe. Review articles and case reports/case series studies were not included. The population are the patients who have the said setbacks, to know the outcome for the aim and objective to answer.

Data Evaluation/ Quality Appraisal

Three independent reviewers screened and reviewed the literature (A.S. and H.Sut.). Any disagreements, such as the lack of concordance in the study selection evaluation, were resolved through discussion with other investigators (H.Sus. and C.D.K.W.) until consensus was reached. The relevance of the title and abstract of the studies was assessed during screening. Mendeley Reference Manager was used to remove any duplicate studies. The following information was gathered from the reference literature: the type of study design, study locations (state and/or country), number of patients studied, number of patients who underwent bariatric surgery and those who did not, comorbidities (e.g., ischemic heart disease, HF, atrial fibrillation (AF), hypertension, dyslipidemia, and diabetes mellitus), patient age, BMI, rate of MACE occurrence, and follow-up period. For RCTs and observational studies, the risk of bias was going to be assessed using the Cochrane Risk of Bias (RoB) 2 Tool (Higgins, 2011) and the Newcastle-Ottawa Scale (NOS) (Wells, 2021). However, no suitable RCT was found in the final stage of study selection, so Cochrane RoB2 was not used.

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Using the Review Manager (RevMan) 5.4.1 software, all outcome variables were summarized and pooled in a meta-analysis (Cochrane Collaboration). The Mantel-Haenszel method was used to analyze dichotomous data, which was presented as the odds ratio (OR). The mean difference was used to present continuous data, which was then analyzed using the Inverse Variance method. The I2 test was used to assess heterogeneity, and data were considered heterogeneous if I2 was greater than 75%, in which case a random-effect model was used. If I2 was greater than 25%, the data was considered homogeneous, and a fixed-effect model was used. Begg's funnel plot was used to assess publication bias visually. When there was publication bias, the trim and fill method was used to correct. If the two-tailed p value was less than 0.05, statistical significance was considered. A comprehensive/matrix table was used to classify the data that had been extracted from the database using the Sparbel& Anderson (2000) tool with the following information: author, year of publication, design, method, sample size and participants, sampling technique, aim, and the study's findings. (Table 1) Experts Reviewers invited to independently validated the table.

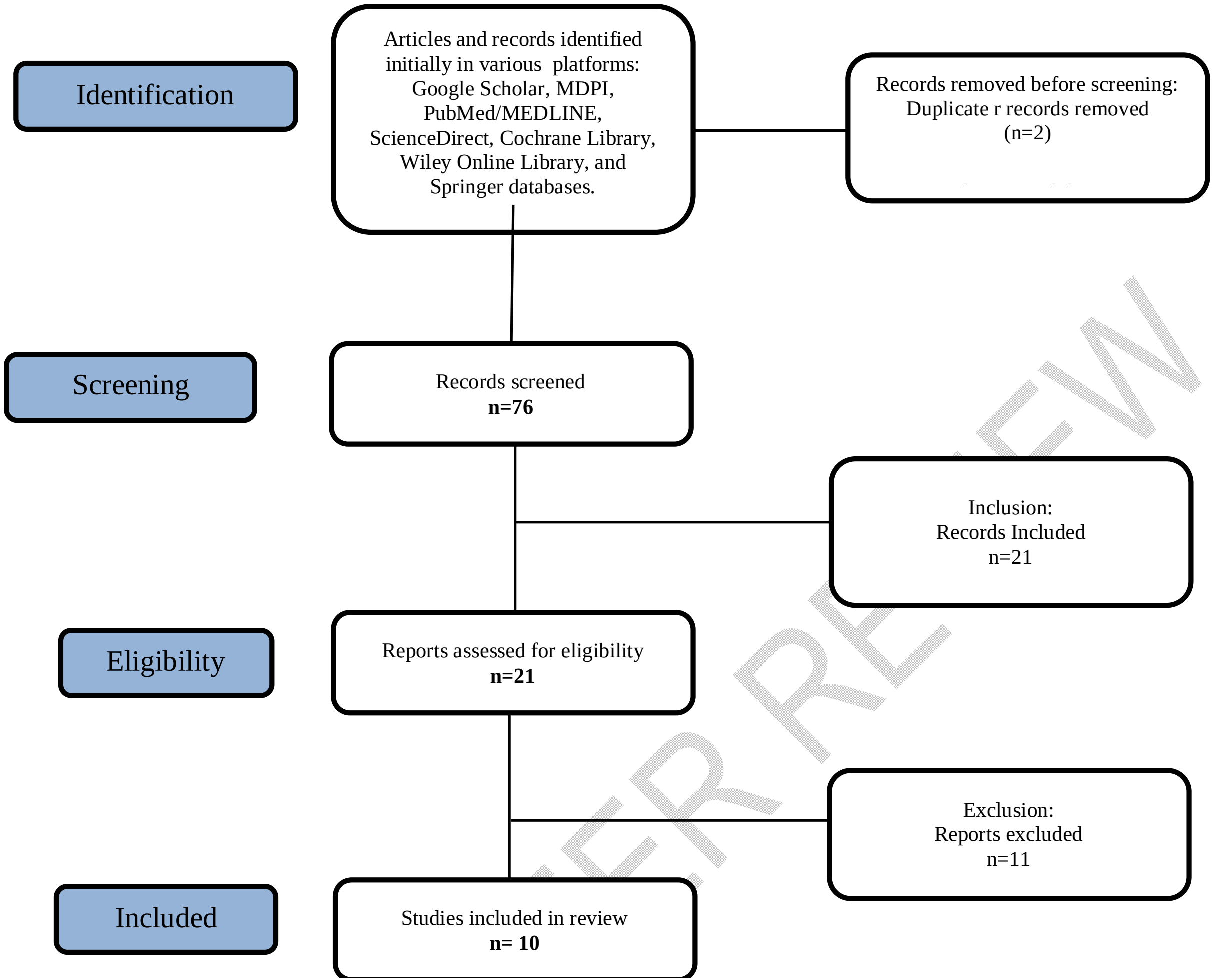

Figure 1. The PRISMA FLow Diagram of the literature search

A total of 176 studies were identified in the literature search, as depicted in the PRISMA flow diagram (Figure 1). Two duplicates were removed, and 16 studies were excluded because of their irrelevance to the aim of this study. Seventy-six records are screened and 21 records are included, following the inclusion criterion. Twenty-one studies were thoroughly reviewed for eligibility. After a thorough review, 11 studies were excluded; thus, 11 studies were included in the review. Ten (10) studies were observational cohort studies and one study was a non-RCT. Subsequently, as can be seen in above figure eleven studies were excluded due to comprehensive screening and the remaining ten studies are included in final records and reports to be included in the review.

III. Results

From the ten (10) studies included in this review, there were 62,658 patients, consisting of 23,845 patients who underwent any form of bariatric surgery and 38,813 patients with no surgery. Reported bariatric procedures included Roux-en-Y gastric bypass, gastric banding, sleeve gastrectomy, biliopancreatic diversion, vertical banded gastroplasty and duodenal switch. The follow-up period of the studies ranged from 3 to 9 years. The detailed study characteristics are summarized in Table 1. Pooled means of the age of the study population were 52.55 years in the bariatric surgery group and 54.09 years in the no-surgery group. Pooled means of the BMI were 42.62 in the bariatric surgery group and 44.59 in the no-surgery group.

Study	Design	Location	Sample Size	Surgical Procedure	Population	Theme
Aminian et al., 2019	Matched Cohort Study	Florida, Ohio, USA	2287= surgery 1145= control	Roux-en-Y Gastric Bypass: 1443 (63) Sleeve Gastrectomy: 730 (32) Gastric Banding: 109 (5) Duodenal Switch: 5 (0.2)	Patients with age 18–80 years, BMI ≥ 30, and diabetes.	Associated in medical history of; (hypertension, dyslipidemia, peripheral neuropathy, HF, coronary artery disease, chronic obstructive pulmonary disease, nephropathy, atrial fibrillation, peripheral artery disease, MI, cerebrovascular disease, ischemic stroke and dialysis). Demographics: Adjusted for index date, sex, age, BMI, weight, race, annual income, smoking status, location of patients
Stenberg et al., 2020	Matched Cohort Study	Sweden	11,863= surgery 26,199= control	Gastric Bypass: 10,692 (90.1) Sleeve Gastrectomy: 1171 (9.9)	Patients with morbid obesity and hypertension	Adjusted for duration of hypertension, comorbidities, and education.
Pirlet et al., 2020	Matched Cohort Study	Quebec, Canada	116 = Surgery 116 = Control	Gastric Bypass: 3 (2.6) Biliopancreatic diversion with duodenal switch: 44 (38) Sleeve gastrectomy: 67 (58) Duodenal Switch only: 2 (1.7	Patients with history of coronary artery disease (CAD) and obesity	Associated and based on propensity score based on age, sex, BMI, weight, status of dyslipidemia, hypertension, diabetes, history of smoking, atrial fibrillation, HF, cancer, stroke, chronic obstructive pulmonary disease, chronic kidney disease, history of MI, history of ercutaneous coronary intervention, revascularization for MI, revascularization for unstable angina.
Moussa et al., 2020	Matched Cohort Study	U.K	3701 = Surgery 3701 = Control	Gastric Bypass: 3002 Sleeve Gastrectomy: 699	Patients with BMI > 35 with a comorbidity or BMI ≥ 40	Adjusted for hypertension, hyperlipidaemia, diabetes, smoking, alcohol use, cocaine use, exercise and use of medications, such as beta-blockers, calcium channel blockers, angiotension converting enzyme inhibitors or angiotensin receptor blockers, statins, aspirin and hormone replacement therapy.

Naslund et al., 2021	Matched Cohort Study	Sweden	509 = Surgery 509 = Control	Roux-en-Y Gastric Bypass: 465 (91) Sleeve Gastrectomy: 44 (9)	Patients with severe obesity and history of MI	Demographic: BMI, smoking, hypertension, chronic kidney disease, peripheral artery disease, HF, atrial fibrillation, chronic obstructive pulmonary disease, cancer disease within 3 years, and treatment with aspirin, P2Y12 receptor blockers, and statins.
Yuan et al., 2021	Retrospective Cohort	Minnesota, USA	308= Surgery 701= Control	Roux-en-Y Gastric Bypass: 308 (100)	Patients with class II-III obesity (BMI > 35)	Adjusted for age and sex. Demographics; Based on age, sex and BMI.
Nguyen et al., 2020	Retrospective Cohort	USA	296= Surgery 1,650= Control	N/A	Adult patients with class II (BMI 35.0 to 39.9) or class III obesity (BMI > 40)	Demographics; gender, hospital region, all patients refined diagnosis related groups severity and risk of mortality, diabetes, hypertension, hyperlipidemia, chronic kidney disease, prior MI, peripheral arterial disease, chronic obstructive pulmonary disease, pulmonary arterial hypertension, atrial fibrillation and smoking.
Doumouras et al., 2021	Matched Cohort Study	Ontario, Canada	1319 = surgery 1319 = Control	Gastric Bypass: 1049 (79.5) Sleeve Gastrectomy: 270 (20.5)	Patients with BMI > 35 with a comorbidity or BMI ≥ 40	Matched based on demographic status, history of smoking, history of diabetes mellitus, cardiac disease, stroke, hypertension, substance abuse, eating and mood disorder, liver and renal disease.
Hung et al., 2020	Matched Cohort Study	Taiwan	1436 = surgery 1436 = Control	N/A	Patients with BMI > 35 with co-morbidities or >40	Adjusted for age, sex, Charlson Comorbidity Index (CCI), comorbidities (i.e., diabetes, hypertension, hyperlipidemia and gout).
Sjostrom et al., 2012	Non-RCT	Sweden	2010 = Surgery 2037 = Control	Gastric Bypass: 265 (13.2) Gastric Banding: 376 (18.7) Vertical Banded Gastroplasty: 1360 (68.1)	Patients aged 37 to 60 years and with BMI of at least 34 for men and at least 38 for women.	A matched control group of participants was created by an automatic matching program using 18 matching variables.

Table 1. Included Studies

The study from Aminian, et al. (2019) utilized a Matched Cohort Study from Florida, Ohio, USA. It concludes with a sample size of 2,287 surgery and 1,145 control. The number of patients undergoes the following surgical procedures: Roux-en-Y Gastric Bypass: 1,443 (63%); Sleeve Gastrectomy: 730 (32%); Gastric Banding: 109 (5%); and Duodenal Switch: 5 (0.2%). It comprises patients with ages between 18 to 80 years, a BMI of more than or equal to 30, and diabetes. The study of Stenberg, et al. (2020) utilized a Matched Cohort Study from Sweden. It concludes with a sample size of 11,863 surgery and 26,199 control. The number of patients who undergoes the following surgical procedures: Gastric Bypass: 10,692 (90.1%) and Sleeve Gastrectomy: 1,171 (9.9%). It comprises patients with morbid obesity and hypertension. The study of Pirlet, et al. (2020) utilized a Matched Cohort Study from Quebec, Canada. It concludes with a sample size of 116 surgery and 116 control. The number of undergo the following surgical procedures: Gastric Bypass: 3 (2.6%); Biliopancreatic diversion with duodenal switch: 44 (38%); Sleeve Gastrectomy: 67 (58%); and Duodenal Switch only: 2 (1.7%). It comprises of patients with a history of coronary artery disease (CAD) and obesity. The study of Moussa, et al. (2020) utilized a Matched Cohort Study from the U.K. It concludes with a sample size of 3,701 surgery and 3,701 control. The number of patients who undergoes the following surgical procedures: Gastric Bypass: 3,002 and Sleeve Gastrectomy: 699. It comprises of patients with a BMI of more than 35 with comorbidity or a BMI of more than or equal to 40. The study of Naslund, et al. (2021) utilized a Matched Cohort Study from Sweden. It concludes with a sample size of 509 surgery and 509 control. The number of patients who undergo the following surgical procedures: Roux-en-Y Gastric Bypass: 465 (91%) and Sleeve Gastrectomy: 44 (9%). It comprises patients with severe obesity and a history of MI.

Furthermore, the study of Yuan and colleague in year 2021 at Minnesota, USA showed that there are 310 patients who undergone bariatric surgery and 710 are in control group. Type of surgery is Roux-en-Y Gastric Bypass: 308 which accumulated to perfect percentage (100%). Patients with class II-III obesity (BMI > 35) are the population. It is evident that the study of Nguyen and colleague, in year 2020 in USA, with 296 patients undergone Surgery and 1,650 patients are belong in Control group. The population areAdult patients with class II (BMI 35.0 to 39.9) or class III obesity (BMI > 40). Moving on, based on the study of Doumouras and colleague in year 2021 at Ontario, Canada, there are 1319 patients, who undergone surgery and 1319 who are in control group. Types of surgery are Gastric Bypass: 1049, with (79.5%) and Sleeve Gastrectomy: 270 (20.5%). The population arePatients with BMI > 35 with a comorbidity or BMI ≥ 40. The ninth article chosen was a work of Hung and friends in year 2020 in the country of Taiwan, it is evident that 1436 patients, undergone surgery and 1436 patients are under in control group. The population are Patients with BMI > 35 with co-morbidities or >40. Lastly, the last article that was screened and reviewed, is the paper of Sjostrom and colleague, in year 2012 at Sweden. It is Evident that 2010 patients undergone Surgery and 2037 are under in control group.

Discussion

Obesity has been linked to an increased risk of diabetes mellitus, coronary artery disease, heart failure (HF), cardiac arrhythmias, and metabolic disorders (Powell-Wiley, 2021). The "obesity paradox" is a phenomenon in which obesity lowers the MACE and shows a better prognosis compared to underweight or normal-weight individuals, despite the established association between obesity and high CV risk (Choi, 2019). This phenomenon is present despite the established association between obesity and high CV risk. This idea is still vague and controversial at this time (Ades, 2010), and the (patho)physiology behind the "obesity paradox" has not yet been fully explained. This paradox raises the question of whether a considerable weight loss in an obese population is beneficial to reducing the incidence of MACE. The study's objective was to determine whether bariatric surgery is effective in reducing MACE in patients with obesity and CVDs. Our meta-analysis revealed that, even after controlling for confounding factors, patients who had bariatric surgery experienced a lower MACE incidence rate than those who did not (OR = 0.49; 95% CI 0.40-0.60; p 0.00001; I2 = 93% and aHR = 0.57; 95% CI 0.49-0.66 This conclusion was consistently found across trials, which is significant because it strongly suggests that bariatric surgery and likely a large weight loss and have impact in general improved the overall CV outcomes in this particular demographic.

Numerous pathways exist that could cause excessive fat to change the body's homeostasis (e.g., cellular metabolism and CV physiology). Protein tyrosine phosphatases (PTP), including PTP-1B and leukocyte antigen-related phosphatase (LAR), are expressed as a result of excessive adiposity. These PTP have been shown to dephosphorylate the insulin receptor and insulin receptor substrate-1 (IRS-1) in vitro, which disrupts insulin sensitivity and energy homeostasis (Singla, 2010). The proinflammatory cytokines tumor necrosis factor (TNF), interleukin (IL)-1, IL-6, plasminogen activator inhibitor-1 (PAI-1), C-reactive protein (CRP), and monocyte chemoattractant protein-1 are all endogenous components of adipose tissue (MCP-1). It has also been suggested more recently that the NOD-, LRR-, and pyrin domain-containing protein-3 (NLRP3) inflammasome may play a role in obesity (Rheinheimer, 2017). Additionally, increased leptin levels caused by extra body fat cause oxidative stress and the activation of NOX, which in turn stimulates NADPH oxidases. Increased risks of inflammation, thrombosis, and insulin resistance result from adipose tissue's proinflammatory nature. Additionally, excessive adiposity can activate RAAS, which encourages salt and water retention as well as vasoconstriction. These pathways may contribute to hypertension, cardiac arrhythmias (such AF), and structural remodeling of the heart (HF) (Sutanto, 2021), along with obesity-induced autonomic nervous system remodeling. Additionally, excessive adiposity may promote the accumulation of cardiac fat. The development of T2DM, another significant risk factor for CVDs due to hyperglycemia, the development of atherosclerotic plaque, and the development of diabetes-induced vasculopathy, may follow obesity-induced insulin resistance (Munoz, 2016).

It has been demonstrated that weight loss, whether accomplished surgically or non-surgically, has a favorable impact on CV physiology. According to a study by Haase and colleagues (Haase, 2021), patients with obesity who lost 13% of their body weight had considerably lower CVD risks, including diabetes, hypertension, and dyslipidemia. Additionally, studies have shown that people with obesity who reduced weight had greater levels of high-density lipoprotein (HDL) and lower levels of triglycerides, CRP, LDL, and HbA1c. The main methods for managing obesity are non-surgical ones, such as pharmaceutical treatment and alterations to lifestyle and food. Studies revealed that the effectiveness of such non-surgical methods was constrained. For instance, a year of lifestyle changes only resulted in a 10% weight decrease. Only 5.3% of the patients were able to sustain their weight loss throughout the following years of observation, and the remaining people gained the weight back (Batsis, 2008). Therefore, in specific circumstances where non-surgical treatments fail to achieve the desired weight loss, a surgical strategy especially bariatric surgery is strongly considered and has multiple impacts.

The term "metabolic" or "bariatric" surgery refers to all surgical methods used to cause weight loss. Patients with a BMI > 40 or BMI > 35 with concomitant conditions (such as CVDs and diabetes mellitus) are eligible [44]. Restrictive and malabsorptive operations are the two main types of bariatric surgery. Examples of restrictive treatments include vertical banded gastroplasty, gastric banding, and sleeve gastrectomy (e.g., jejunoileal bypass, duodenal switch and Roux-en-Y gastric bypass). Some techniques (such as gastric banding, vertical banded gastroplasty, and jejunoileal bypass) are less common because of unfavorable side effects, high rates of complications or reoperations, and short-term efficacy (Arterburn, 2020). According to reports, bariatric surgery can enhance heart function and CV outcomes by reducing or eliminating CV risk factors such hypertension, diabetes, and dyslipidemia. The advantages of bariatric surgery in glucose and fat metabolism have been documented in numerous research. For instance, bariatric surgery increased insulin sensitivity, which improved diabetes mellitus. Postprandial glucagon-like peptide-1 (GLP-1) was released more after Roux-en-Y gastric bypass surgery, which enhanced insulin output. Moreover, the unexpected negative calorie balance Within days following surgery, post-surgery-induced blood glucose stabilization occurred (Knop 2013). Although the precise mechanism is still uncertain, another study found that bariatric surgery boosted HDL cholesterol and decreased both LDL cholesterol and triglycerides (Spivak, 2017). Following bariatric surgery, patients with obesity also showed several improvements in cardiac function, including a decrease in left ventricular mass and an increase in left ventricular ejection fraction (Beamish, 2016).

Overall, weight loss may just be one of the ways that bariatric surgery influences CV outcomes, despite the existence of the obesity and CV diseases paradox, which this study did not resolve (Tsilingiris, 2019). There is also a chance that bariatric surgery will have indirect benefits for MACE. Psychologically influenced dietary practices in postoperative patients can impact weight loss and, in turn, the risk of MACE (Aarts, 2015). Furthermore, decreased sympathetic nervous system activity may alter the risk of MACE following bariatric surgery (Doumouras, 2121). Additionally, investigations showed that after bariatric surgery, natriuretic peptide levels increased and RAAS performance was corrected in obese patients (Bonfils, 2015). Finally, individuals following bariatric surgery were shown to have increased adiponectin and insulin sensitivity as well as decreased levels of leptin, CRP, and IL-6 (Woelnerhanssen, 2011). According to our meta-analysis, these effects improve metabolic and CV processes generally and hence lessen the likelihood of developing MACE.

Nevertheless, depending on the treatment, bariatric surgery might have a number of consequences. In general, it is impossible to ignore the hazards associated with gastrointestinal obstructions (such as internal hernia, intussusception, and anastomosis stenosis). There is a chance for gastric necrosis, specifically with gastric banding. Following bariatric surgery, dumping syndrome (a combination of sweating, dizziness, palpitations, stomach pain, nausea, vomiting, and/or diarrhea caused by rapid gastric emptying) could also happen (Ma, 2015).

Last but not least, this systematic review and meta-analysis has a number of drawbacks. First, due to a lack of sufficient data, the study did not distinguish between outcomes based on various bariatric surgeries. Due to data accessibility issues, the potential interactions between covariates were not fully examined. Third, the interpretability of our results is additionally constrained by the lack of RCT. RCTs would eventually be required to validate or corroborate our findings. Further study based on specific bariatric treatment types and a more thorough analysis of specific MACE components are also necessary.

Implication For Practice

Obesity is one of the world's most serious health issues. Bariatric surgery is one of the fastest growing surgical procedures and is widely regarded as the best option for weight loss. Despite advancements in bariatric surgical procedure performance, complications are not uncommon. This patient population has a number of unique complications that necessitate specialized knowledge for proper management. In addition, conditions unrelated to the altered anatomy usually necessitate a different management strategy. As a result, the practicing gastroenterologist must have a basic understanding of surgical anatomy, potential complications, and endoscopic tools and techniques for optimal management. These procedures and complication management strategies should be familiar to gastroenterologists. This review will cover these topics as well as major complications that gastroenterologists are likely to encounter in their practice.

Obesity and metabolic disorders can be effectively treated with bariatric surgery. Endoscopists are more likely than ever to encounter this patient cohort on routine diagnostic lists, as the number of bariatric procedures performed annually rises. Endoscopy is used to diagnose and treat complications associated with bariatric surgery in both the preoperative and postoperative periods. Preoperative endoscopy may be useful in identifying pathologies, which may influence the type of bariatric surgery proposed. Postoperative endoscopy has long been used to detect and treat complications such as anastomotic leaks and gastrointestinal bleeding. These complications may be managed without the need for surgical intervention or revision as endoscopic techniques advance. Increased knowledge and awareness of the indications for endoscopy, as well as the altered anatomy and common complications of bariatric surgery, is critical in effectively managing these patients.

Limitation and Recommendations

The limitations in this study was about the majority of review have looked at obese women during their reproductive years, including pregnancy. A healthy and balanced diet, combined with nutritional education from a nutritionist/dietitian, has been shown to be critical during this period in preventing excessive weight gain and postpartum weight retention in women. It is also a risk factor for the development of gestational diabetes, hypertension, and pre-eclampsia.

In a present study of 62,658 patients, a randomized clinical trial and a systematic review found that sugary food consumption was a risk factor for greater gestational weight gain. According to a meta-analysis of cohort studies involving 23,845 patients, who underwent any form of bariatric surgery, as measured by the Healthy Eating Index, have a lower risk of cancer mortality. To define healthy eating, we used the NOVA classification. That is, the majority of fresh and minimally processed foods are consumed, with the addition of culinary ingredients and processed foods characterizing culinary preparations (Monteiro, 2016). In terms of NOVA, we found no randomized controlled trials examining the impact of food consumption on obese women. A recent meta-analysis presented data from two studies indicating a significant association between ultra-processed food consumption and increased gestational weight gain in pregnant women (Monteiro, 2021).

Public health policies and programs that assist the population in promoting a healthy food environment are important tools for the prevention of obesity and other NCDs and necessitate the participation of the government, public, and private sectors. These initiatives include food guides with graphical representations of the diet and healthy eating recommendations, which are relevant guidelines for the general population to adopt new healthy eating habits. Another example is the 5-a-day campaign, which encourages people to eat five portions of fruits and vegetables per day. Given the importance of this theme for health promotion and disease prevention, as well as the lack of specific recommendations for women, it is important to have programs that tailor their approach to them.

Conclusion

The systematic and integrative reviewshowed that patients with obesity and CVDs who underwent bariatric surgery had considerably reduced MACE than those who underwent no surgery. The study showed that Bariatric surgery has impacts on patients who have obesity and CVDs. An increase in heart function, normalization of glucose and lipid metabolism, and an improvement in overall CV outcomes could all contribute to a MACE-lowering effect.

Diets appear to support promising outcomes in terms of weight control and decreased CVD and cancer risk in obese clients. Such diets, meanwhile, could be challenging to follow for a lengthy period of time. In terms of nutrition, we must take into account that a healthy diet should be learnt and implemented into a person's daily routine, not just for short periods of time with a sole concentration on weight loss. The greatest strategy to prevent and treat female overweight and obesity as well as lower the risk of cancer and CVD is through this sort of nutritional treatment, which mostly depends on adopting a better eating pattern and food education.

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