

# BARIATRIC SURGERY AND EFFECTS ON CVD: REVIEW OF RECENT STUDIES

**DR. MOHAMED SHARSHAR**

Consultant Bariatric, Laparoscopic & HPB surgeon

Fellow lecturer of surgery

Alexandria University Students` Hospital

-MSc, PhD - Alexandria University

-MRCS – Ireland

-Clinical research Fellow, St. James University Hospital - UK

-IFSO, ESBS member -IHPBA member

## Introduction

- Patients with **obesity** often have multiple cardiovascular comorbidities.
- This is because **obesity** is an established risk factor for various cardiovascular diseases (CVDs) including heart failure (HF), coronary artery disease (CAD), hypertension, dysrhythmia, and venous thromboembolism.

## BMI (WHO 2019)

BMI	Term	Class of Obesity
<19	Underweight	
19-25	Ideal BMI	
25-30	Overweight	
>30	Obese	I
>35	Severely Obese	II
>40	Morbidly Obese	III
>50	Super Obese	IV

- Obesity imposes a significant threat to **national public health** as well as a substantial **economic burden**.
- A study published in the New England Journal of Medicine 2 years ago pointed out that 19 million **Egyptians** are obese, accounting for 35% of the adult population, **the highest rate in the world**. Among children, 3.6 million (10.2%) are obese.

- Among many approaches to treat severe obesity, studies have demonstrated that **bariatric surgery** is the most effective and cost-effective treatment, which not only leads to substantial weight loss but also results in higher remission rates of type 2 diabetes mellitus (DM), hypertension, and hyperlipidemia.

## **Objective**

The main objective of the current review article is to overview the effects of bariatric surgery on the overall and various types of CVD.

## Impact of obesity on overall health

- Obesity is now recognized as **the first leading cause of premature mortality** followed by cancer and DM, and the biggest issue behind this incidence is the association between obesity and CVD.
- Recent studies have further investigated how both the duration and degree of obesity affect the risk of different CVDs. Data from the Coronary Artery Risk Development in Young Adults study showed that, **for every 2 years lived with obesity, the risk of CVD mortality significantly increased by 7%.**

- A **meta-analysis** on 4 different cohorts from England, Finland, France, and Sweden **demonstrated that** people with class II obesity could expect to live 6-7 fewer years in good health and 7-9 fewer years without chronic diseases compared to those with normal weight.

## Effectiveness of Non-invasive Interventions for Obesity

- the first treatment step typically includes diet, lifestyle, exercise, and behavioral modification, and this is the basis for every subsequent step.
- The guidelines recommend these basic treatments plus medication as the next step if weight loss of 5–10% is not achieved within 6 months.
- The last step combines these strategies with bariatric surgery.

- Although many studies indicate that programs combining diet and exercise produce meaningful weight loss in individuals with obesity, a **meta-analysis of non-invasive interventions has shown that it is challenging to sustain the initial weight loss over 1 year.**
- The reason is that individuals were likely to return, perhaps partially, to their original lifestyle patterns since the lifestyle reform program lasted for a short period of time.
- May also be the poor access to education from qualified nutrition professionals on certain skills and behaviors to maintain their achieved weight loss.

## Bariatric surgery

Surgical procedures aim to **promote weight loss** in obese patients by changing the anatomy of digestive system, limiting the amount of food that can be eaten and/or digested.

## Indications (NIH)

**Who is a good adult candidate for bariatric surgery?**

- a body mass index (BMI) of 40 or more, OR.
- a BMI of 35 or more with a significant health problem linked to obesity, such as type 2 diabetes, CVD or sleep apnea.

## Effects of Bariatric Surgery on CVD Risk Factors, Myocardial Infarction, Stroke, and Mortality

- A number of meta-analyses of RCTs with 2 years of follow-up demonstrated that bariatric surgery leads to substantial weight loss (~36 kg) and improve the control of **CVD risk factors** with the remission rate of 73% in DM, 63% in hypertension, and 65% in hyperlipidemia.
- Further, in a large prospective cohort study, bariatric surgery was shown to reduce the composite of **mortality, myocardial infarction, and stroke** with hazard ratio [HR] of 0.67.



## Heart Failure

- obesity is an independent risk factor for multiple **chronic conditions** (e.g., hypertension, CAD, left ventricular hypertrophy), which may eventually lead to the development HF.
- Patients with obesity tend to have larger left ventricular (LV) mass and wall thickness, both of which result in **higher LV diastolic filling pressure**.
- “**obesity cardiomyopathy**”, proposing that excessive epicardial fat may exert direct cardiotoxicity.
- Additionally, **hyperinsulinemia** and activation of **renin-angiotensin-aldosterone axis** may play a role in the development of HF and exacerbation in patients with obesity.

- weight reduction achieved by bariatric surgery could reduce the risk of incident HF (i.e., **primary prevention**)
- A nationwide cohort study of 47,859 patients with obesity reported that the overall incidence of HF was **5 times lower among patients who underwent bariatric surgery** than the non-surgical patients.
- Another cohort study of 3,448 patients with obesity suggested that, after follow-up of up to 8 years, patients who had bariatric surgery had a **reduced risk of incident HF and lower risk of death from HF**.

- With regard to **secondary prevention** of HF (i.e., prevention of morbidities in patients who have already developed HF), bariatric surgery may be effective in reducing LV wall thickness and mass, LV filling pressures, especially in patients with HF with preserved ejection fraction (HFpEF)
- a study of 12 patients with HFpEF and obesity reported that LV wall thickness and mass regressed significantly after bariatric surgery. **The relative wall thickness regressed from 0.44 at baseline to 0.42 at 3 months and to 0.39 at 6 months**, and patients experienced fewer HF symptoms postoperatively

- Another study suggested that bariatric surgery can improve **LV diastolic functions (DF)** and thus lead to better control of diastolic HF.
- Moreover, There was a self-controlled case series study of **1,664 patients** with obesity and HFpEF who underwent bariatric surgery, using the population-based databases of all emergency department (ED) visits and hospitalizations in 3 states in the US, and demonstrated that up to **>40% reduction in the risk of HF exacerbation after bariatric surgery.**

- Yet, it remains **unknown** whether bariatric surgery **offers mortality benefit** in patients with obesity with HF—if it does, bariatric surgery may become the first and only intervention to improve mortality in patients with HFpEF



- **Obesity** may worsen the control of SAP through accelerating coronary atherosclerosis, endothelial dysfunction, and LV hypertrophy, and increasing demand for cardiac output .
- With regard to the **primary prevention** of angina, a nationwide retrospective cohort study revealed, with a mean follow-up of 4 years, **strong protective associations** between bariatric surgery and the incidence of angina (HR 0.59)

- In terms of **secondary prevention** of SAP, little has been investigated about whether weight reduction contributes to the improvement of SAP-related morbidity.
- In a recent self-controlled case series study of 953 obese adults with SAP who underwent bariatric surgery, it was elucidated that **the rate of hospitalizations for SAP was reduced by approximately two thirds after bariatric surgery.**

- **Possible explanations** for the reduction of the rate of the SAP-related morbidity include the improvement of LV hypertrophy, blood pressure, glycemic control, and lipid profile through substantial weight loss.
- Additionally, bariatric surgery, at least theoretically, may have favorable effects on endothelial function, systemic inflammation, and oxidative stress.
- This have contributed to the reduction in the risk of **developing new-onset angina** and to **the better control of angina-related symptoms.**



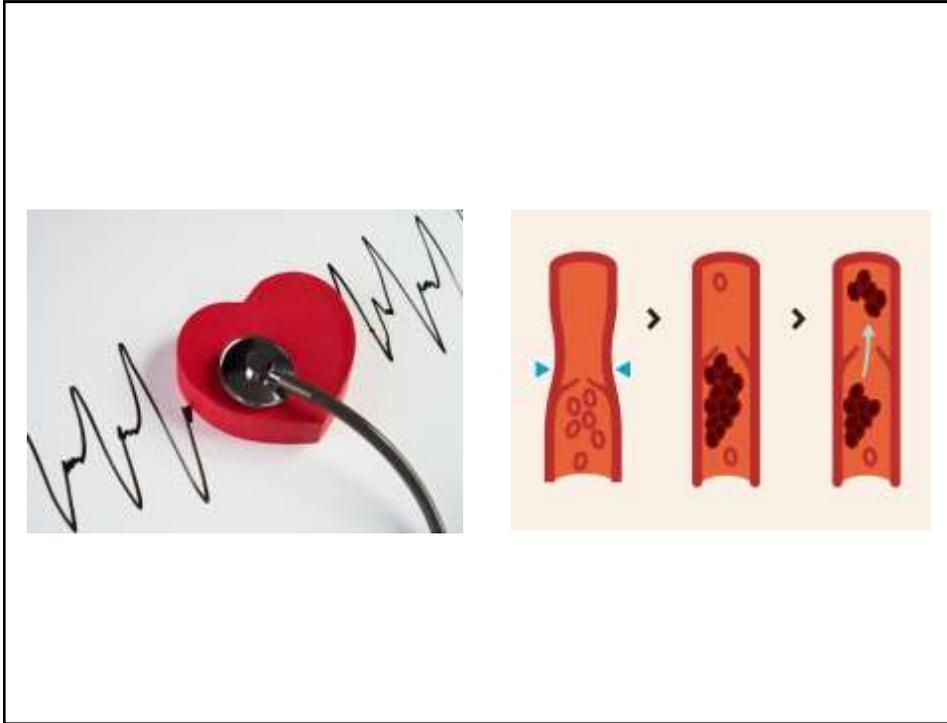
- Obesity is associated with elevated risk of **uncontrolled hypertension**. Inadequate hypertension control in obesity has emerged as a vital issue.
- With regard to **primary prevention** of hypertension, a meta-analysis with a median follow-up of 36 months showed that the risk of incident hypertension decreased after bariatric surgery (RR 0.54).

- Randomized trial of 96 patients with obesity and hypertension showed that **improvement was observed in 84% of patients in the bariatric surgery group** compared with 13% in the non-surgical group.
- Moreover, **51% of patients in the bariatric surgery group showed remission of hypertension**, while no patients in the non-surgical group were free of antihypertensive drugs at 12 months.

- A **recent systematic review** also demonstrated that bariatric surgery resulted in resolution of hypertension in 58% of patients at 1-year and that 75% of patients experienced resolution or improvement of hypertension.

- Few studies have examined **the effect of bariatric surgery on the prevention of hypertension-related acute care use** (e.g., ED visits and unplanned hospitalizations).
- In a study of 980 patients with obesity and hypertension who underwent bariatric surgery, ~18% of the study population had an acute care use for hypertension during the 1-year pre-surgery period. **Within the first year after bariatric surgery, the rate significantly decreased to ~12%.**

- Overall, growing evidence supports that **bariatric surgery is highly effective** in preventing the development of new-onset hypertension, and is also a promising approach for avoiding hypertension-related acute care use among patients with hypertension.



- **Obesity** is known to be one of the potent risk factors for developing dysrhythmias. Moreover, it has been suggested in several prospective cohort studies that substantial weight loss may reduce the incidence of new-onset AF.
- A study of **5,044 patients** observed that the incidence of new-onset AF was significantly lower in the surgical group compared to the non-surgical group (0.8 vs. 2.9%). In the surgical group, higher preoperative BMI and older age were risk factors for the development of new-onset AF.

- Given these prior reports, bariatric surgery has been **expected** to reduce the risk of AF-related morbidities (e.g., ED visits, hospitalizations) among patients with pre-existing AF.
- Nonetheless, in a recent study of patients with obesity and AF who underwent bariatric surgery, the risk of AF-related acute care use transiently **increased** for a few months after the surgery.
- Then, the risk did **come back** to the preoperative level **but did not** go any lower

- This would be **probably attributable to** a number of factors including postoperative inflammation, anemia if there was blood loss, electrolyte abnormalities, and infection.
- Also the adverse remodeling and fibrotic changes of the left atrium may be **advanced and irreversible** even after a substantial weight reduction with bariatric surgery in some patients with long-standing disease.

- Similar relationship was observed with regard to **obesity, VTE, and bariatric surgery**.
- Obesity is an established, and perhaps one of the strongest, risk factor for developing VTE. Therefore, it would be natural to **hypothesize** that a substantial weight loss would reduce the risk of VTE-related acute care use.
- **Yet**, a recent study showed that the risk of acute care use for VTE was transiently **increased** after bariatric surgery in the immediate postoperative period, and was back to the baseline level within a few months but not further reduced during a 2-year follow-up.

## **Bariatric surgery effect on overall CVD**

- **The favorable effects** of substantial weight loss, achieved by bariatric surgery, on the morbidities related to various types of CVD—e.g., myocardial infarction, stroke, HF, SAP, and hypertension.
- **On the other hand**, it was also displayed that bariatric surgery may not be effective in reducing the risk of acute care use due to certain types of CVD (e.g., dysrhythmia, VTE)—it may even worsen the control of these CVDs in the early postoperative period.

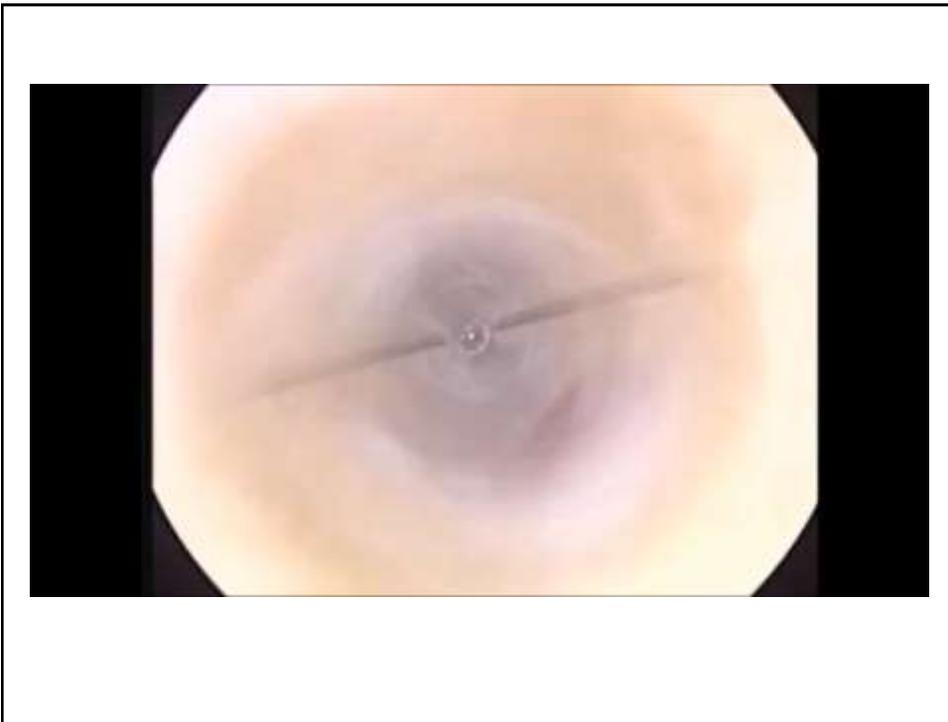
- In a cohort study that analyzed **11,106** adults with obesity and CVD who underwent bariatric surgery, the risk of CVD-related acute care use (i.e., ED visit, unplanned hospitalization) reduced from 21 to 19% during the first postoperative year and to 17% during the second postoperative year.
- The **effect size was smaller** in this study on the **overall CVD compared to** the previously mentioned studies which focused on the **individual CVD** showing 40–70% risk reduction.
- This is probably because **the benefit** on ischemic CVDs and HF was partially offset by **the transient unfavorable effects** on dysrhythmia and VTE.

## Conclusion

- Thanks to the recent advancements in the understanding of the CV effects of bariatric surgery, it has been elucidated that substantial weight loss achieved with bariatric surgery can prevent morbidities related to a variety of CVDs such as myocardial infarction, stroke, HF, SAP, and hypertension.
- On the other hand, it has also been exhibited that bariatric surgery may not be effective in certain types of CVDs—e.g., dysrhythmias, VTE.

- Combined with the existing data on the short-term and long-term complications of bariatric surgery, the recent series of studies on the CV effects of bariatric surgery provided more precise information on its risk-benefit balance in patients with CVD.
- This would in turn help physicians and patients to make informed and individualized decisions on the selection of treatment options for severe obesity between lifestyle modifications, pharmacological treatment, and bariatric surgery, especially when there is a co-existing CVD.





**THANK YOU**