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The Obesity Paradox in Cardiothoracic Surgery

Mandour O Mandour[1]* and Ahmed M Osman[2]

[1]Department of Hepatology, Cambridge University Hospital, Cambridge, UK
[2]Department of Cardiothoracic Surgery, University Hospitals of North Midlands NHS Foundation trust, Stoke-On-Trent, UK

Introduction

The world health organisation (WHO) define obesity as ''abnormal or excessive fat accumulation that may impair health''. Commonly, the body mass index (BMI) is used as a measure of whether someone is underweight (BMI <19 kg/m^2), healthy weight (BMI 19-24 kg/m^2), overweight (BMI 25-29 kg/m^2), obese (BMI 30-39 kg/m^2) and a BMI >40 kg/m^2 considered as extreme obesity.

There is ethnic variability which can affect the accuracy of BMI. For example, increased muscle mass in those of Afro-Caribbean ethnicity can increase BMI. It is therefore suggested that waist circumference measurement should be performed in addition to BMI to allow a more accurate assessment of cardiometabolic risk associated with obesity [1].

The latest WHO observatory data suggests that global obesity has nearly tripled from 1975 to 2016 [2]. More that 1.9 billion adults in 2016 were considered overweight with 650 million of these considered obese [2]. Moreover, 39% of adults aged 18 years and over were overweight with 13% considered obese in 2016 [2]. More significantly, these increases were not just restricted to ''Western'' developed countries, but there were also substantial increases seen in low-income and middle-income countries thus this global crisis being labelled a pandemic [2].

There are various obesity risk stratifying systems in use currently including Kings obesity staging criteria and Edmonton obesity system, however the WHO class staging system is the most common in use currently [3-5].

With various genetic and epigenetic factors associated with obesity, this condition should be thought of as a chronic disease rather than simply due to overeating.

Obesity in the setting of cardiothoracic surgery

It is well documented that obesity is a major risk factor for both cardiovascular disease and cancer, it affects all facets of healthcare, and its incidence worldwide is increasing dramatically [6,7]. Yet, surprisingly, there have been repeated reports of a reverse J- or U-shaped relationship between BMI and surgical survival outcomes. This inverse relationship is known as the obesity paradox [8].

Counterintuitively in the cardiac surgical population, a clear obesity survival advantage has been shown on several observational data, demonstrating lower operative mortality, and improved early and mid-term survival in the overweight and moderately obese [8-10]. In obese patients undergoing lobectomy for benign and malignant lung tumours, Tulinský et al assessed the short-term outcomes and concluded that obesity does not increase the incidence and severity of intraoperative or postoperative complications after lung lobectomy, and reported slightly better outcomes in obese patients, indicating that obesity paradox might be a reality in patients undergoing lung resection [9].

Nonetheless, beyond the improved early surgical outcomes, the obesity paradox disappears with the natural progression of cardiometabolic disease. Despite no differences observed according to BMI in the initial in-hospital outcomes, there is an 11% higher adjusted risk of 5-year cardiac mortality associated with each unit increase in BMI [11]. Therefore, the aetiological role of obesity that may have led to the cardiac surgery cannot be overlooked [8].

Postoperative complications of all organ systems appear to be more prevalent in obese individuals, and particularly in cardiothoracic surgery, the surgical peculiarities further increase this risk [10]. Briefly speaking, cardiopulmonary bypass (CPB) activates different coagulation, proinflammatory, and survival cascades, and is associated with an altered redox state. Inevitably, end-organ function and recovery are affected, due to the oxidative stress and the associated activation of proinflammatory and proapoptotic signalling pathways [12]. Furthermore, the profound post-operative metabolic changes exerted by the systemic inflammatory response, along with the effects of anaesthesia, drugs and blood products used to maintain cardiovascular function perioperatively, contribute to an altered systemic end-organ response. [8].

On clinical ground alone, each increase in BMI class almost doubles the incidence of postoperative hypoxia, with the morbidly obese experiencing an increased risk of prolonged ventilation and its consequences [13]. Interestingly enough, there is a growing body of evidence describing that obesity protects against blood loss and transfusion in coronary artery bypass surgery (CABG) [14]. However, following both CABG and valvular surgery, several studies showed a significant association between cardiac surgery associated acute kidney injury (AKI) and obesity. Indeed, BMI was an independent risk factor for postoperative AKI. Furthermore, wound infections following cardiac surgery in this subset of patients are known to plague the postoperative course [10]. Moreover, from a cardiovascular view point, postoperative atrial fibrillation (AF) is the commonest rhythm disturbance after cardiac surgery, and obesity was associated with a slightly higher risk of postoperative AF; this was further associated with a substantially higher risk of major postoperative complications including stroke, respiratory failure, and operative mortality after all types of cardiac surgical procedures [15].

In conclusion, the impact of BMI has been consistently analysed in studies that aim to identify risk factors for increased early complications and extended length of stay to enhance quality and provide cost-effective means of patient centred care. An ongoing study by Aguiar et al (the impact of Obesity on Postoperative Outcomes following cardiac Surgery (OPOS) study) aims to better differentiate obese patients who

***Corresponding author:** Mandour Omer Mandour, Department of Hepatology, Cambridge University Hospitals, Cambridge, United Kingdom, E-mail: omer.mandour@nhs.net

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experience fewer complications from those with increased rates of adverse events [16].

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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Conflict of Interest

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Informed Consent

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