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FOCUS ON: BARIATRIC

Anaesthetic considerations and management of the obese patient presenting for bariatric surgery

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S U M M A R Y

The prevalence of morbid obesity in the United Kingdom is increasing at an exponential rate. The field of bariatric surgery has expanded accordingly over the past decade. Obesity related co-morbidity increases the risk of perioperative complications, and morbidly obese patients presenting for bariatric surgery pose particular challenges to the anaesthetist. This article addresses key issues relevant to pre-operative assessment, and anaesthetic management of morbidly obese patients presenting for bariatric surgery.

1. Introduction

Historically, obesity has been associated with affluence and fertility. With rates of both adult and childhood obesity rapidly rising, obesity no longer signifies affluence but is instead becoming one of the leading public health issues facing the developed world. Between 1993 and 2004, the prevalence of adults in England with a Body Mass Index (BMI) of 30 kg/m^2 or greater increased from 13.6% to 24.0% in men and from 16.9% to 24.4% in women. If recent trends in adult obesity continue, it has been projected that approximately a third of all adults (almost 13 million individuals) will be obese by 2012.[1] Obesity has long been recognized as a precursor of morbidity and premature mortality. Epidemiological studies show morbidity and mortality to be positively correlated with a BMI $>$ 30 kg/m^2, and individuals with a BMI $>$ 35 kg/m^2 at aged 50 years have double the risk of premature death.

The field of bariatric surgery in the UK has undergone exponential growth within the last decade. Bariatric surgery is associated with improved rates of sustained weight loss, long-term reduction in obesity-related disease and a decline in long-term mortality.[2]

The obese patient presents particular challenges for the anaesthetist. We can expect to be increasingly confronted with this patient population, as the demand for bariatric intervention escalates. This article reviews the anaesthetic assessment and management of the morbidly obese patient presenting for bariatric surgery. The surgical management of obesity is discussed elsewhere in this issue by Khwaja and Bonanomi.[3]

2. Background

The World Health Organization (WHO) classifies obesity based on BMI, and describes;

Class I obesity – BMI of 30–34.99,
Class II obesity – BMI of 35–39.99,
Class III obesity – BMI equal to or greater than 40.

Individuals with a BMI of 35 or greater who have concomitant, obesity-associated disease or those with a BMI of 40 or greater, regardless of co-morbidities, are described as morbidly obese. Although BMI is the most commonly used tool for assessing the severity of obesity, it is not necessarily the best clinical predictor of disease. The *distribution* of adipose tissue rather than the absolute weight or BMI per se, appears to be more clinically relevant. Centrally distributed adipose tissue (android obesity), is more metabolically active than peripheral tissue, and there is an increased incidence of metabolic complications in individuals with a waist circumference greater than 102 cm in men, and 89 cm in women. Those with extensive visceral fat are also at greater risk of ischaemic heart disease (IHD), hypertension, premature coronary death and stroke.[4]

In the UK, the National Institute for Health and Clinical Excellence (NICE) recommends bariatric surgery as an intervention when non-surgical measures for weight loss have failed to achieve or maintain clinically beneficial weight loss for at least 6 months. This guidance refers to adults with a BMI of $\geq$40 kg/m^2, or $\geq$35 kg/m^2 plus significant obesity-related disease likely to improve with weight loss. Surgical intervention is recommended as a first-line option in super morbidly obese adults (BMI $\geq$ 50 kg/m^2).[5] Rates of post-operative morbidity and mortality following bariatric surgery

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vary between institutions. Santry reviewed bariatric surgical admissions across the United States between 1998 and 2003, of which gastric bypass surgery accounted for 80% of procedures.[6] The observed in-hospital mortality rate was between 0.1% and 0.2%, unexpected re-operation rate for surgical complications of 6–9%, and respiratory and cardiac complications varied from 4–7% to 1–1.4% respectively. Known predictors of post-operative complications include male gender, surgical inexperience, age $\geq$45 years, BMI $\geq$ 50 kg/m^2, Obstructive Sleep Apnoea (OSA), asthma, diabetes mellitus, hypertension and those at increased risk of venous thromboembolism.

Contra-indications to bariatric surgery include mental and cognitive impairment, ongoing substance abuse, advanced liver disease with portal hypertension, malignancy with poor 5-year prognosis, unstable coronary artery disease (CAD) and uncontrolled severe OSA with pulmonary hypertension. Age is not a contra-indication per se, but careful assessment of functional capacity and co-morbidity is warranted in these patients to ensure suitability.

3. Pre-operative assessment

The objective of pre-operative assessment is to optimize patient outcomes. It facilitates the appropriate selection of patients suitable for bariatric surgery, enables timely identification and treatment of pre-existing medical conditions, and determines how and where each patient should be managed post operatively. The bariatric multi-disciplinary team (MDT) approach to pre-operative assessment ensures that patients are appropriately selected, informed and motivated, and optimized medically. At this institution, all new bariatric referrals are initially assessed by a bariatric clinical nurse specialist, prior to discussion at MDT meetings. These are attended by dieticians, psychologists, endocrinologists, respiratory physicians, anaesthetists and bariatric surgeons. High risk patients are identified and referred for further assessment by a bariatric anaesthetist in a consultant-run, bariatric pre-assessment clinic. The pre-operative interview takes place 6–12 weeks in advance of the proposed date for surgery. It allows for comprehensive history-taking and thorough physical examination with particular attention to the airway, respiratory and cardiovascular systems. Where further investigation or management is indicated, there are easily accessible and efficient referral pathways for specialist consultation in sleep and respiratory medicine, endocrinology, cardiology and psychiatry.

3.1. Airway

Obese patients have traditionally been considered to be at increased risk of difficult tracheal intubation. However, studies have shown that absolute weight and BMI per se are poor predictors of difficult tracheal intubation, whereas large neck circumference ($>$40 cm), Mallampati score $\geq$3 and thyromental distance $<$6 cm are more specific indicators of potential difficulty.[7] Assessment and management of the obese airway is thoroughly addressed elsewhere in this issue by Myatt and Haire.[8]

3.2. Respiratory system

Obese patients have increased basal oxygen consumption and carbon dioxide production. Obesity is also associated with decreased lung and chest wall compliance, increased airways resistance and reduced functional residual capacity (FRC). The latter often falls below the closing capacity, resulting in atelectasis, ventilation/perfusion mismatch and impaired oxygenation.[9] The supine position, induction of anaesthesia and pneumoperitoneum during laparoscopic procedures further compound these effects.

Baseline respiratory function should be established from the patient history and physical examination. Smoking contributes to both respiratory and cardiovascular disease and has been identified as an independent risk factor for post-operative complications after bariatric surgery.[15] Cessation of smoking for $>$8 weeks preoperatively is associated with improved cardiovascular parameters and a reduction in post-operative pulmonary complications. Chest X-ray, arterial blood gas analysis and pulmonary function tests (PFTS) should be selectively performed where clinically indicated. Patients with reversible, obstructive respiratory deficit should be optimized by respiratory specialists prior to surgery.

OSA is strongly associated with obesity. The prevalence of OSA in morbidly obese patients is approximately 70%, and the condition is often undiagnosed. Individuals with a large neck circumference (collar size $>$43 cm in men or $>$40 cm in women) are at increased risk. This population of patients may be at increased risk for peri-operative morbidity and mortality. Our practice is to screen patients based on their history (witnessed apnoeas, snoring, disturbed sleep) and the Epworth Sleepiness Scale. Patients scoring $\geq$12 or with a history strongly suggestive of OSA, are then referred for polysomnography. If the study is positive for OSA (Apnoea: Hypopnoea Index $>$5 per h), patients are commenced on nocturnal continuous positive airways pressure (CPAP) or bilevel positive pressure (BiPAP) ventilation for 6–12 weeks prior to surgery. The optimal duration of treatment prior to surgery is unclear, and some benefit may be gained from shorter treatment periods. If OSA is moderate or severe, baseline PaO_2, $PaCO_2$ and bicarbonate are determined.

3.3. Cardiovascular

Cardiovascular complications following high risk, non-cardiac surgery are an important cause of morbidity and mortality. Obesity, particularly the android variety, is recognized as an independent risk factor for coronary artery disease (CAD). Additionally, other obesity related sequelae can compound CAD, culminating in cardiac failure (Figs. 1 and 2), and a poor post-operative outcome. Timely pre-operative assessment facilitates thorough evaluation of cardiac risk and implementation of medical measures wherever possible, to minimise risk.

Cardiac function can be difficult to ascertain in morbidly obese patients from the clinical history, as mobility is frequently limited. Clinical examination can be unreliable as heart sounds are muffled, necks of a larger circumference conceal jugular venous pressure (JVP) and peripheral oedema may be attributed to a sedentary lifestyle. Functional capacity can be better assessed according to the patient's ability to undertake activities of daily living. Those able to perform activities requiring at least 4 metabolic equivalents (METs), e.g. climbing a flight of stairs, walking up-hill or walking on level ground at 4 miles per hour, are classified as having moderate functional capacity. The Revised Cardiac Risk Index is commonly used to assess cardiac risk in patients undergoing non-cardiac surgery, and identifies 6 independent predictors of cardiac complications (high-risk surgery, IHD, congestive cardiac failure, cerebrovascular disease, IDDM, and renal insufficiency). Based on this model and the patient's functional capacity, the AHA/ACC have produced a framework for the selection of patients who should proceed to provocative cardiac testing (Fig. 3).[11] Patients with functional capacity greater than 4 METS and no risk factors undergoing bariatric surgery are generally considered to be at low risk of cardiovascular complications, and can usually proceed to surgery without further investigation. In contrast, the sedentary patient without a history of cardiovascular disease, but risk factors predictive of increased cardiac risk, should be considered for