Special Considerations in Obese Patients

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The prevalence of obesity in the United States has increased rapidly over the past few decades. The third National Health and Nutrition Examination Survey (NHANES III, 1988-1991) found that the prevalence of obesity has increased from 25% to 33%, a 31% increase since NHANES II (1976-1980).[1] With these facts in mind, it is important that the surgical risks of obesity be considered in both preoperative evaluation and postoperative care.

Obesity is defined as a body mass index (BMI) of 30 kg/m^2 or higher, based on the World Health Organization classification. BMI is calculated by the formula [weight (in kilograms)/height (in meters) ^{2}]. If weight is measured in pounds, the formula [weight (in pounds)/height (in inches)^2] x 703 provides the same results. A BMI of 30.0 to 34.9 kg/m^2 is classified as obesity class I, 35.0 to 39.9 kg/m^2 as obesity class II, and greater than 40 kg/m^2 as class III (extreme or morbid obesity).[2]

The significance of obesity is that it increases overall morbidity and mortality due to its association with several other comorbid conditions. Obesity increases the risk for hypertension, coronary artery disease, dyslipidemia, and type 2 diabetes mellitus (insulin resistance syndrome). Obesity is also associated with obstructive sleep apnea, obesity hypoventilation syndrome, osteoarthritis, reflux esophagitis, biliary tract disease, urinary stress incontinence, and several malignancies, including colon, breast, prostate, and endometrial cancer.[2,3] Table 1 summarizes increased disease risk for type 2 diabetes, hypertension, and cardiovascular disease based on BMI and waist circumference.[2]

Morbid obesity has been thought to be a potential risk factor for poor outcome in several types of surgery. However, relatively few studies have evaluated the actual risks. The few studies that have evaluated the outcome of emergent and trauma surgery have found severe obesity to be associated with increased mortality (42%) as compared to normal weight individuals (5%).[3] Obese burn patients have also been discovered to have higher mortality rates and increased complications. Regarding elective surgeries, studies in general have shown no significantly increased mortality in severely obese individuals. The primary areas in which obesity can increase surgical risks are: cardiovascular, respiratory, infectious, and thromboembolic disease. This discussion will be limited to those in the extremely obese range.

Cardiovascular Risks

Obesity alone, in the absence of other comorbid conditions, can produce changes in cardiac structure and function.[4] Obese persons generally have increased intravascular volume and cardiac output because of the high metabolic activity of excessive fat. In moderate to severe cases of obesity, adaptation to these chronic conditions can result in the development of eccentric left ventricular hypertrophy, which in turn significantly increases the risk of acute myocardial ischemia and infarction, congestive heart failure (CHF), and sudden cardiac death. Approximately 10% of patients with extreme obesity for a duration of ≥10 years develop a clinical syndrome known as obesity cardiomyopathy, which is associated with left ventricular (LV) diastolic and systolic dysfunction.[4] Even asymptomatic morbidly obese patients have been discovered to have increases in LV mass and abnormalities in LV diastolic filling. Therefore, preoperative cardiac assessment with electrocardiography should be considered in all morbidly obese patients over age 20 years.[3] Echocardiography should be performed only in those patients with clinical symptoms suggestive of CHF. It must be noted, however, that optimal complete transthoracic echocardiograms can be obtained in only 70% of morbidly obese patients due to weight limitations in the technique.[4]

Table 1: Disease Risk by BMI and Waist Circumference

		Disease Risk: Waist Circumference	
Weight	BMI	M ≤ 40 in W ≤ 35 in	M > 40 in W > 35 in
Normal	18.5 to 24.9	Low	Low
Overweight	25.0 to 29.9	Increased	High
Obesity class I	30.0 to 34.9	High	Very High
Obesity class II	35.0 to 39.9	Very High	Very High
Obesity class III	≥ 40	Extremely High	Extremely high

Pulmonary Risks

Obesity is strongly associated with obstructive sleep apnea (OSA) and the obesity hypoventilation syndrome (OHS). In fact, these conditions may be present in over 55% of morbidly obese individuals.[3] OSA is associated with abnormalities in pulmonary control, right and left cardiac ventricular dysfunction, and increased risk of myocardial infarction, stroke, and sudden death. OHS should be suspected in obese patients presenting with extreme dyspnea, a history of CHF, and nocturnal asthma. Hypoventilation in this condition results from excessive weight of the chest wall. Its diagnosis is confirmed by arterial blood gas evaluation showing a $PaCO_2$ of greater than 45 mmHg. OHS increases the incidence of pulmonary hypertension and right-sided heart failure.[3]

In preoperative evaluation, it is important to know whether a patient has OSA because even mild OSA can be exacerbated in combination with general anesthesia and narcotic analgesia. For morbidly obese patients with no other identifiable risk factors, routine pulmonary function tests (PFT) as part of the pre-operative assessment is not indicated.[5] The most common PFT abnormality seen with obesity is a decreased expiratory reserve volume.[6] After surgery, patients with OSA should be maintained on mechanical ventilation in the intensive care unit until they can be safely extubated, which is usually the next day.[3] The initial tidal volume should be calculated based on ideal body weight, as calculation using actual weight will cause overestimation that in turn can lead to barotrauma.[6] Patients who were already on nocturnal continuous positive airway pressure (CPAP) prior to admission should resume CPAP the evening following extubation. OHS patients may also require mechanical ventilation postoperatively. Since many of these patients are chronic CO2 retainers, weaning from mechanical ventilation should aim towards the patient's baseline ABG values rather than normal values.[3]

In addition to OSA and OHS, other pulmonary complications can occur in obese individuals. Atelectasis occurs in up to 30% of obese individuals who undergo general anesthesia.[3] Furthermore, the risk of aspiration pneumonia is higher in obese patients, especially in the postoperative period, due to increased intra-abdominal pressure and elevated gastric residual volumes with lower intragastric pH.[3,6] Although obesity by itself is not a statistically significant risk factor for pulmonary complications[7], the risk of postoperative pulmonary complications is increased in obese patients in combination with other risk factors, especially thoracic and upper abdominal surgeries and history of blunt trauma.[6]

The best measures to take to avoid postoperative respiratory complications in obese patients are to encourage the use of incentive spirometry, respiratory monitoring with pulse oximetry, aggressive chest physiotherapy, pain control with minimal respiration depression, early mobilization, and maintenance in a semi-upright rather than flat position.[6]

Thromboembolic Risks

Obesity is a well-known predisposing factor for postoperative thrombophlebitis, deep venous thrombosis (DVT), and pulmonary embolism (PE). Many autopsy series and retrospective studies have found an increased incidence of obesity in patients with PE or DVT.[3] However, several prospective studies have not been able to document a significantly increased incidence of thromboembolic risks, even in obese patients undergoing high-risk procedures such as total hip arthroplasty.[3] A recent study showed that surgically induced weight loss had benefit in correcting venous stasis disease in morbidly obese patients.[8] Because obese patients with OHS and OSA have a higher likelihood of having pulmonary hypertension, there is an increased risk of fatal PE in these individuals.

Recommendations for reducing the risk of thromboembolic disease in obese patients include early mobilization and use of aggressive DVT prophylaxis. These DVT prophylaxis measures include the administration of low-dose heparin and/or the application of pneumatic compression stockings. Low-molecular weight heparins can be used in place of low-dose heparin. Further studies of low-molecular weight heparin use in the obese population need to be conducted. Regardless of which of these methods are used, the prophylactic measures should be initiated before the administration of anesthesia and continued postoperatively until the patient is able to ambulate.[3]

Wound Complications

Wound complications occur more frequently in obese than in non-obese individuals. In fact, wound infections most commonly cause morbidity in obese patients after gastric bypass surgery or gastroplasty. Other surgeries associated with a high incidence of wound infection in obese persons include duodenal ulcer surgery, hysterectomy, cesarean section, coronary artery bypass graft, cholecystectomy, and renal transplantation. Of note, morbid obesity is not a contraindication for laparoscopic surgery.[9] Although morbid obesity has been documented to

be one of the risk factors for wound dehiscence, the clinical incidence is relatively low at 1%.[3] The best measure to prevent these wound infections is the use of perioperative antibiotics.

Summary

Perioperative risks to consider in obese individuals include cardiovascular, pulmonary, thromboembolic and wound complications. Obese patients are at risk for several medical disorders that in turn can exacerbate these risks. However, with awareness of these potential risks and appropriate perioperative management, the incidence of serious complications can be greatly reduced. In most instances, obese individuals can be treated as effectively and safely as normal weight individuals. They should not be denied surgery when appropriately indicated based on weight.

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