Perioperative Implications and Management of Obesity

Bradley A Bishop, MD[1], Napoleon P Roux, MD[1]
[1]San Antonio Uniformed Services Health Educations Consortium (SAUSHEC), San Antonio, TX

Learning Objectives:

- Define obesity
- Discuss anesthetic implications of obesity by system
- Discuss management of obesity in the perioperative setting

Introduction:

Obesity is a systemic disease with many implications to perioperative care.
US obesity prevalence has increased from 30.5% (1999-2000) to 42.4% (2017-2018) with prevalence of severe obesity increased from 4.7% to 9.2% in the same time period. This rapid increase highlights the need for a thorough understanding of the obese patient. perioperative management of obese patients requires an understanding of anatomic and physiologic changes as well as common associated comorbidities in order to improve patient outcomes.

Figure 1: Positioning for Intubation in Morbidly Obese Patients. Adapted from Zvara et al, 2006.

Case Presentation:

Pre-operative:
The patient was a 27-year-old female with Obesity Class 3 (BMI 62), diabetes mellitus type 2, GERD, and anxiety who sustained a mechanical fall tripping over a sprinkler head with subsequent right posterior knee dislocation and popliteal artery injury. She was transferred from an outside hospital after knee reduction. Complaint of paresthesias and immobility to right foot. History of anaphylaxis to IV contrast prompted decision to intubate in ED prior to imaging. Patient placed on ramp with blankets, preoxygenated, and underwent rapid sequence intubation (RSI) with ketamine, propofol, and succinylcholine with a video laryngoscope (glidescope) for intubation.

Intra-operative:
The patient received general endotracheal anesthesia with sevofluorane and opioids as needed throughout popliteal artery repair. No significant intraoperative events occurred. The procedure lasted approximately 2.5 hours.

Post-operative:
The patient's post-operative course was uncomplicated with biphasic DP and PT signals on doppler at time of discharge.

Discussion:

Diagnosis: Overweight and obesity are defined by WHO as abnormal or excessive fat accumulation that may impair health. Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. Defined as a person's weight in kilograms divided by the square of height in meters (kg/m2).

Weight Classifications by Body Mass Index

NHLBI Terminology	BMI Range (kg/m^2)	WHO Classification
Underweight	<18.5	Underweight
Normal	18.5–24.9	Normal range
Overweight	25.0–29.9	Preobese
Obesity class 1	30–34.9	Obese class 1
Obesity class 2	35.0–39.9	Obese class 2
Obesity class 3	≥40.0	Obese class 3

NHLBI=National Heart, Lung, and Blood Institute
WHO=World Health Organization

Anesthetic Implications by System:

***Respiratory*:**
- Increased risk of perioperative hypoxemia
  - Decreased pulmonary compliance -> decreased Functional Residual Capacity (FRC) made worse with anesthesia and supine positioning
- Obesity increases O2 consumption and CO2 production at rest
- Association with OSA
- Risk for Obesity Hypoventilation Syndrome

Cardiovascular:
- Increased total blood volume
  - Less than non-obese patients in volume to weight (50 mL/kg vs 70 mL/kg)
- Increased Cardiac output
  - Excess body fat increases CO by up to 20-30 mL/kg
- Increased LV wall thickness
  - Hypertrophy, reduced compliance and LV diastolic dysfunction
- Increased proinflammatory/prothrombotic mediators
- Higher incidence of hypertension, thromboembolic events

Gastrointestinal:
- Risk of Regurgitation
- Increased gastric volume and lower pH
  - Increased risk for severe pneumonitis if aspiration occurs
  - Current preop fasting guidelines unchanged from normal weight
- Altered hepatic function
  - Abnormal ALTs most common
  - Liver pathologies associated w/ obesity include NAFLD, NASH, focal necrosis and cirrhosis.

Endocrine:
- Increased prevalence of hyperglycemia, insulin resistance, DM
  - RR of developing DM increases by 25% every 1 kg/m2 over BMI of 22
- Metabolic syndrome
  - Central obesity, HTN, dyslipidemia and impaired glucose metabolism
- Subclinical hypothyroid in 25% of morbidly obese

Anesthetic Implications by System (cont):

Renal:
- Increase risk of renal disease
  - Glomerular hyperfiltration, impaired natriuresis, loss of nephron function
- Higher incidence of preeclampsia/eclampsia

Hematologic:
- Increased hypercoagulability and risk of perioperative thromboembolic events
- Preoperative polycythemia
  - Suggestive of prolonged history of apnea

Perioperative Management:

Preoperative evaluation should include a complete airway exam to determine patient risk factors for difficult ventilation or difficult intubation. Furthermore, a careful cardiopulmonary exam is critical as cardiac and pulmonary impairment in the setting of obesity can be erroneously attributed to deconditioning. Lastly, attention to labs indicating poor glycemic control, electrolyte/vitamin deficiencies, or clotting/bleeding disorders should be reviewed as these are common issues in the obese patient.

Intraoperative Considerations are ensuring appropriate equipment/monitoring such as BP cuff size, invasive monitoring if NIV cuff has inappropriate fit, and strapping to table. Airway management to include head up position during preoxygenation and a ramp for intubation with video laryngoscope, fiberoptic, or supraglottic airway available for difficult airways are also recommended. RSI to reduce risk of regurgitation is appropriate. It is important to dose medications appropriately based on total body weight (TBW) vs lean body weight (LBW). Short acting opioids and a multi-modal pain approach to minimize post op respiratory depression is important in this patient population. As blood loss is greater in obese than non obese patients, targeting of normovolemia based on ideal body weight is favored. Obese patients are more likely to be have pulmonary atelectasis and will benefit from PEEP, but care should be taken in regards to complications from higher tidal volumes and airway pressures. Lastly, post-extubation recovery in sitting position with supplemental O2 will result in fewer pulmonary complications post-operatively.

Conclusion:

Obesity is among the most common diseases an anesthesia provider will encounter in the perioperative period. Recognition of systemic changes from obesity and appropriate management techniques can help mitigate perioperative risk factors and improve patient outcomes.

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