Anesthesia for obese patient

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Introduction:

- Obesity (body weight of 20% or more above ideal weight) is associated with increased morbidity and mortality and a wide spectrum of medical and surgical diseases.
- Risk of premature death is doubled in the obese population and risk of death resulting from cardiovascular disease is increased fivefold in the obese compared with the nonobese.
- Obesity is a global health problem and the prevalence varies with socio-economic status.

Introduction:

- Morbid obesity is defined in terms of body mass index (BMI).
- BMI is calculated by establishing a ratio between the patient's weight and height as follows: Body mass index (BMI) = weight in kg/height in m2
- BMI values are classified as follows:

- BMI of 18.5–24.9 = normal
- BMI of 25.0–29.9 = overweight
- BMI of 30.0–34.9 = class I obesity
- BMI of 35.0–39.9 = class II obesity
- BMI of 40.0 or greater = class III obesity (sever or morbid obesity)

Introduction:

- Interestingly, the regional distribution of excess fat is thought to be more predictive than BMI for morbidity and mortality.
- Excessive abdominal fat, "**central obesity**" is particularly predictive for NIDDM, dyslipidaemia and cardiovascular disease.
- Waist circumferences need to be sex and race specific.

Introduction:

Pathophysiology :

- Obesity is a complex, multifactorial disease (mechanisms of fat storage, genetic, psychologic). Most simply, it occurs when net energy intake exceeds net energy expenditure over a prolonged period of time.

Pathophysiology :

Cardiovascular Disorders :

a. Systemic Hypertension : Obesity-induced hypertension is related to the effects of hyperinsulinemia on the sympathetic nervous system and extracellular fluid volume.

Insulin also activates adipose tissue to release angiotensinogen. Increased circulatory cytokines cause vascular damage and fibrosis, increasing arterial stiffness. Left ventricular (LV) hypertrophy can develop. Pulmonary hypertension is common and most likely reflects the impact of chronic arterial hypoxemia or increased pulmonary blood volume (or both). Weight loss significantly improves, or even resolves, hypertension.

Pathophysiology :

Cardiovascular Disorders :

b. Coronary Artery Disease :

Obesity seems to be an independent risk factor for the development of ischemic heart disease and is more common in individuals with central/android fat distribution.

Pathophysiology :

Cardiovascular Disorders :

c. Congestive Heart Failure : Systemic hypertension causes concentric LV hypertrophy and a progressively noncompliant left ventricle, which, when combined with hypervolemia, increases the risk of congestive heart failure. Obesity-induced cardiomyopathy is associated with hypervolemia and increased cardiac output. Insulin resistance also appears to play a role via cardiac steatosis, lipoapoptosis, and activation of cardiac genes that promote LV remodeling. Some of these structural and functional changes may reverse with significant weight loss.

Pathophysiology :

Respiratory disorders :

Since obesity is a multisystem disease affecting all organs, there are a number of implications relevant to the conduct of anaesthesia:

a. Lung Volumes : Obesity imposes a restrictive ventilatory defect because the weight of the thoracic cage and abdomen impedes the motion of the diaphragm and decreases functional residual capacity (FRC), especially in the supine position. These changes are accentuated by general anesthesia and impair the ability of obese patients to tolerate apnea (i.e., during direct laryngoscopy), resulting in rapid arterial oxygen desaturation after induction of anesthesia, often despite preoxygenation.

Pathophysiology :

Respiratory disorders :

b. Gas Exchange and Work of Breathing : Paco2 and ventilatory response to carbondioxide remain within a normal range in obese patients. Normocapnia is maintained by increased minute ventilation, resulting in increased work of breathing.

c. Lung Compliance and Resistance : Obesity is associated with a decrease in lung compliance and an increase in airway resistance that result in rapid, shallow breathing patterns and increased work of breathing that is most marked in the supine position.

Pathophysiology :

Respiratory disorders :

d. Obstructive Sleep Apnea (OSA) :

OSA is cessation of breathing for more than 10 seconds during sleep, and hypopnea is a reduction in the size and number of breaths compared with normal breathing.

- ✓ At least 5% of morbidly obese patients will have OSA
- ✓ Is caused by passive collapse of the pharyngeal airway during deeper planes of sleep, resulting in snoring and intermittent airway obstruction.

Pathophysiology :

Respiratory disorders :

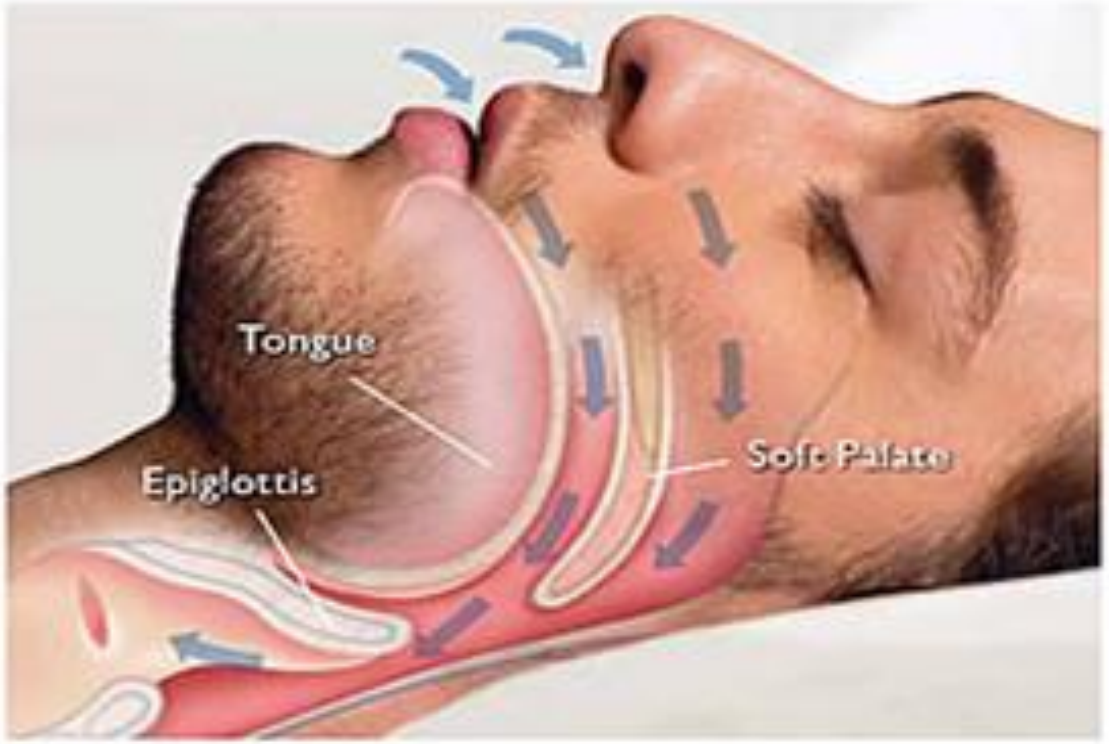
d. Obstructive Sleep Apnea (OSA) :

- ✓ hypoxemia and hypercapnia results in arousal and disruption of quality sleep thus causing the characteristic daytime somnolence.
- ✓ Pulmonary and systemic vasoconstriction, polycythemia, and right ventricular failure all occur and can cause type II respiratory failure
- ✓ treatment includes removal of precipitants, weight loss and nocturnal CPAP.

Pathophysiology :

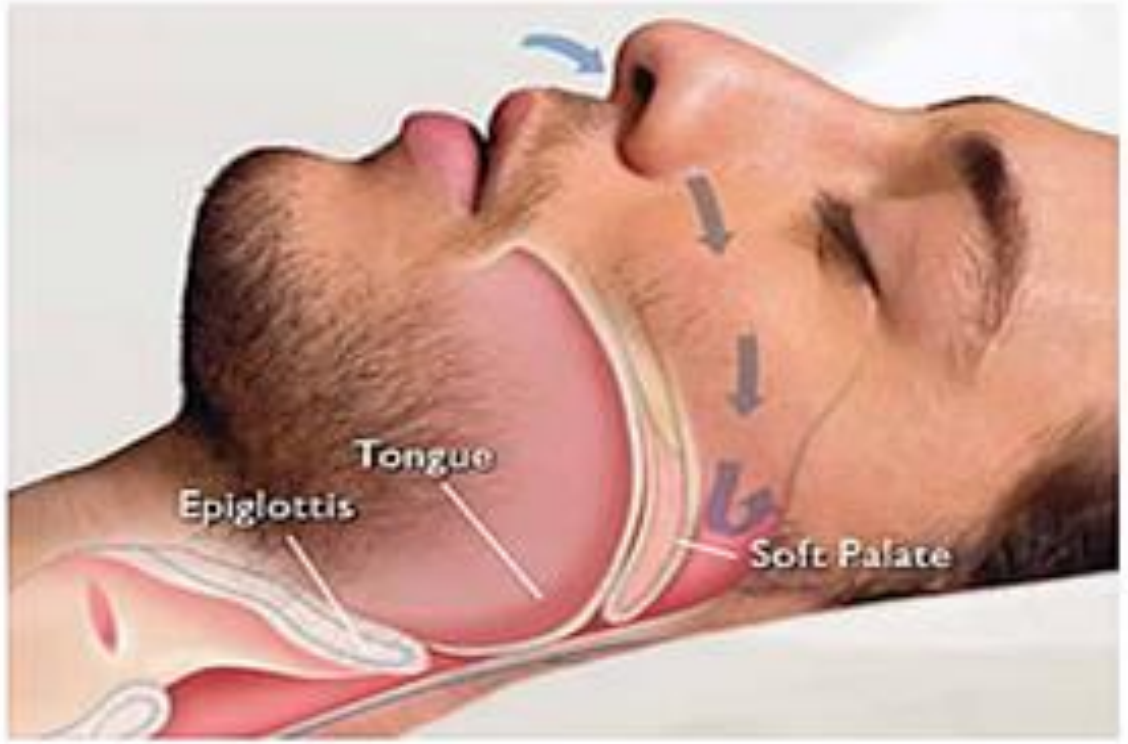
Respiratory disorders :

d. Obstructive Sleep Apnea (OSA) :



Normal breathing

During sleep, air can travel freely to and from your lungs through your airways.



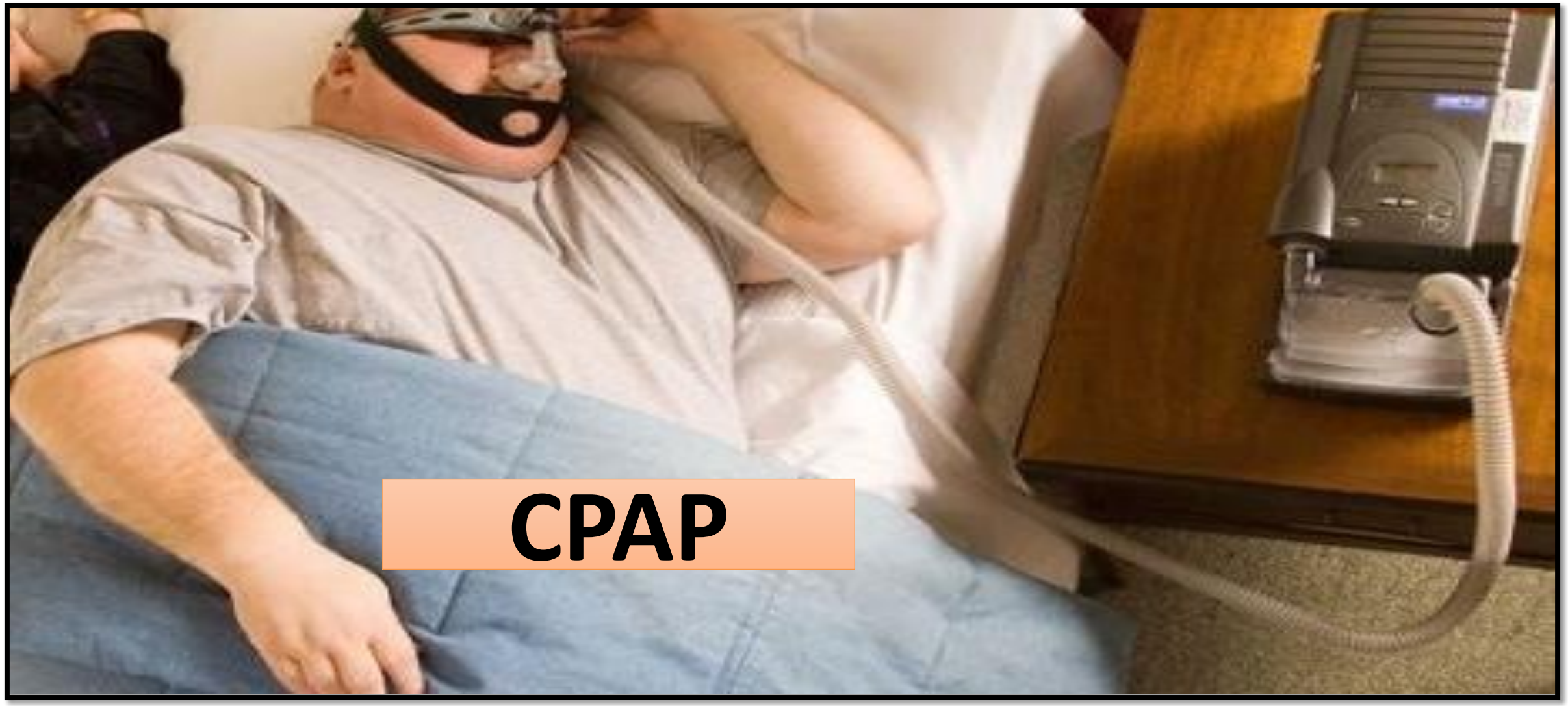
Obstructive Sleep Apnoea

Your airway collapses, stopping air from traveling freely to and from your lungs and disturbing your sleep.

Pathophysiology :

Respiratory disorders :

d. Obstructive Sleep Apnea (OSA) :



Specific Anaesthetic considerations:

- ✓ Avoid sedative premedication (difficult to maintain airway)
- ✓ Airway obstruction is very likely to occur in the postoperative period (give oxygen and apply CPAP if required)
- ✓ Regional techniques and short acting anaesthetic agents are ideal to reduce postoperative drowsiness.
- ✓ Consider nocturnal oxygen for up to 5 days following major surgery if available.
- ✓ Regional anesthesia plus noninvasive mechanical ventilation represented the preferred techniques for obese patient with respiratory problems.

Airway :

- Obese patients tend to have short, fat necks making both mask ventilation and direct laryngoscopy technically more challenging.
- A high BMI is associated with increased risk of difficult intubation.

Airway :

Specific Anaesthetic considerations :

- ✓ Always assess the airway for prediction of difficult intubation.
- ✓ Difficult mask ventilation can sometimes be transformed by placement of an oral airway; typically, laryngeal mask airways (LMAs) are used for this purpose.
- ✓ Obese women are more likely to have large breasts, which can interfere with easy placement of the laryngoscope, therefore aim for a degree of head-up tilt,and if necessary, apply traction on the breasts to allow placement of the laryngoscope.

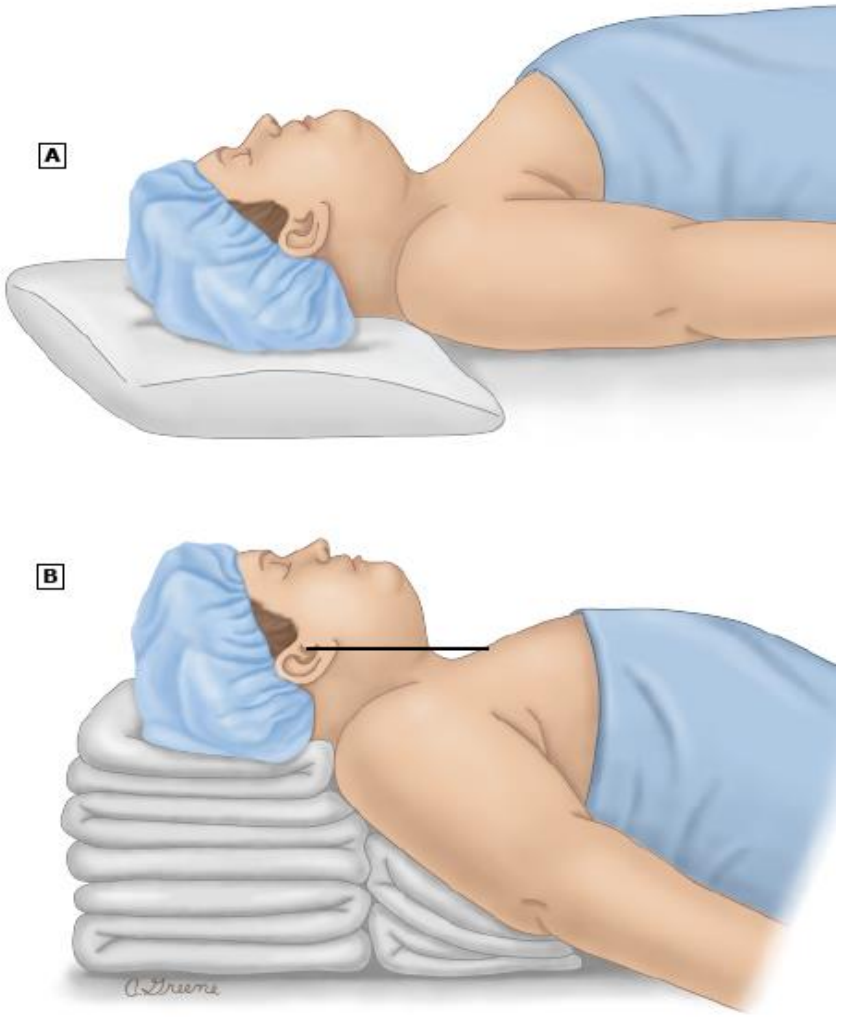
Airway :

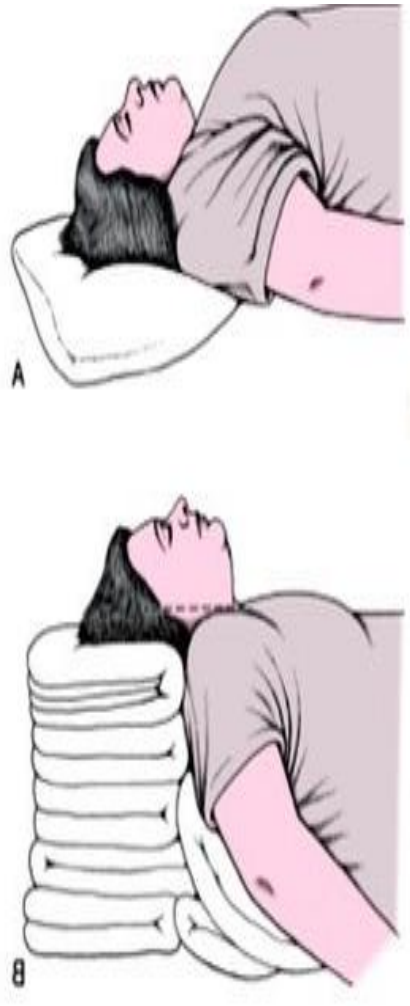
Specific Anaesthetic considerations :

- ✓ LMAs and other supraglottic airway devices remain relatively contraindicated forelective use in MO patients, but are acceptable choices for emergency use.
- ✓ For intubation, ramps are recommended to achieve optimal sniffing position. These ramps are created by placing folded blankets under the patient's shoulders, neck, and occiput. The idea is to bring the patient's chin to a higher point than the chest.

Airway :

Specific Anaesthetic considerations :





Inflammatory Syndrome of Obesity :

Obese patients have a higher rate of perioperative infections, which may be caused by impaired neutrophil function secondary to secretion of proinflammatory cytokines by adipocytes.

Thromboembolic Disorders :

The risk of deep vein thrombosis in obese patients undergoing surgery is approximately double that of nonobese individuals due to polycythemia, increased intraabdominal pressure, and immobilization. Risk of stroke is also increased. For every 1 unit increase in BMI above normal, there is a 4% increase in risk of ischemic stroke and 6% increase in risk of hemorrhagic stroke.

Anesthesia management :

1. Preoperative Evaluation :

The focus is on cardiovascular and respiratory systems and airway evaluation.

a. History The history should focus on symptoms such as chest pain, syncope, exertional dyspnea, and symptoms suggestive of OSA. Other concerns include the presence of GERD, control of systemic hypertension, and the presence of diabetes (diagnosed or previously undiagnosed).

b. Physical Examination Any signs of respiratory or cardiac compromise should be identified, and a detailed assessment of the airway performed. Intravenous access should be assessed.

Anesthesia management :

1. Preoperative Evaluation :

c. Preoperative Diagnostic Testing

Tests may include

electrocardiography (looking for signs of right heart strain or right or left ventricular hypertrophy), chest x-ray examination if congestive heart failure is suspected, transthoracic echocardiography to evaluate left and right ventricular function and pulmonary hypertension, and arterial blood gases if severe OSA is suspected.

Anesthesia management :

1. Preoperative Evaluation :

d. Home Medications : Most medications should be continued perioperatively, with the exception of oral hypoglycemics, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, anticoagulants, and nonsteroidal anti-inflammatory drugs. Proton pump inhibitors should be taken the morning of surgery, and deep venous thromboembolism prophylaxis should be considered (low-molecular-weight heparin or unfractionated heparin).

Anesthesia management :

1. Preoperative Evaluation :

e. Continuous Positive Airway Pressure (CPAP) or Bi-Level Positive Airway Pressure (BiPAP) :

If such treatment is used at home, the patient should bring the mask so that this therapy can be continued in the perioperative period.

Anesthesia management :

2- Intraoperative Management :

a. Positioning : Specially designed operating room tables may be needed, and special transfer devices (such as air transfer mattresses) can minimize the risk of injury to patient or staff. "Ramping" the patient may allow better ventilator mechanics. Pressure points require special attention. Neutral arm position is preferred when possible.

Anesthesia management :

2- Intraoperative Management :

b. Laparoscopic Surgery : Pneumoperitoneum during laparoscopy causes physiologic changes that may be accentuated in obesity (increased venous return if abdominal pressure is 10 mm Hg or less, and decreased venous return with abdominal pressure 20 mm Hg or more with decreased cardiac output; hypercarbia, acidosis, and increased pulmonary vascular resistance; higher myocardial oxygen demand). Trendelenburg positioning may further compromise ventilation.

Anesthesia management :

2- Intraoperative Management :

c. Choice of Anesthesia : Local or regional anesthesia is preferable to general anesthesia if feasible.

i. Regional Anesthesia :

In obese patients' regional anesthesia may be technically difficult, as bony landmarks are obscured. Local anesthetic requirements for spinal and epidural anesthesia in obese patients may be as much as 20% lower than in nonobese patients.

Anesthesia management :

2- Intraoperative Management :

ii. Regional Anesthesia :

A- premedication :

Use of benzodiazepines is controversial owing to risk of upper airway obstruction.

Anesthesia management :

2- Intraoperative Management :

ii. Regional Anesthesia :

B- Airway Management :

Difficulties with mask ventilation and tracheal intubation may occur (because of fat face and cheeks, short neck, large tongue, excessive palatal and pharyngeal soft tissue, restricted mouth opening, limited mandibular mobility, or large breasts). Emergency airway equipment should be readily available. Rapid decreases in arterial oxygenation may be seen with direct laryngoscopy and tracheal intubation, and adequate preoxygenation is critical.

Anesthesia management :

2- Intraoperative Management :

ii. Regional Anesthesia :

B- Airway Management :

Awake intubation may be a consideration in some patients. Obese patients are traditionally presumed to be at increased risk of pulmonary aspiration during the induction of anesthesia, but the risk of pulmonary aspiration is related to difficult tracheal intubation rather than to BMI. Use of a laryngeal mask airway (LMA) is successful in aiding intubation in 96% of obese patients and is successful in establishing ventilation in less than 1 minute in almost 100% of obese patients.

Anesthesia management :

2- Intraoperative Management :

Pharmacokinetics :

The dosage of injectable drugs is hard to predict. Total blood volume may be increased, but fat has relatively low blood flow, and doses based on total weight may be relatively excessive. In general, loading doses should be based on lean body weight. Lean body weight is total body weight minus fat weight. In clinically severe obesity, lean body weight accounts for 20% to 40% of excess body weight. Cardiac output is increased, which can affect drug distribution after intravenous injection.

Anesthesia management :

2- Intraoperative Management :

Pharmacokinetics :

Repeat injections should be based on pharmacologic response but can result in cumulative drug effects owing to storage of drug in fat. Liver dysfunction may decrease drug clearance from the circulation. Awakening of obese patients is more prompt after exposure to desflurane or sevoflurane than after administration of either isoflurane or propofol. Ketamine and dexmedetomidine may be useful anesthetic adjuncts for patients who are susceptible to narcotic-induced respiratory depression.

Anesthesia management :

2- Intraoperative Management :

Monitoring :

The technical difficulty of placing intravenous catheters and invasive monitors may be increased by the presence of obesity. Invasive arterial monitoring should be used for the morbidly obese with severe cardiopulmonary disease and for those patients in whom a poor fit of the noninvasive blood pressure cuff is likely because of the severe conical shape of the upper arms or unavailability of appropriately sized cuffs.

Anesthesia management :

2- Intraoperative Management :

Monitoring :

Transesophageal echocardiography and/or pulmonary artery catheterization may be needed in patients with CHF or pulmonary hypertension. For surgeries performed with the patient under local or regional anesthesia, capnography is recommended to decrease the risk of undetected airway obstruction.

Anesthesia management :

2- Intraoperative Management :

Fluid Management :

Fluid management should be based on lean body weight. Urinary output during laparoscopic surgery does not necessarily reflect volume status.

Anesthesia management :

3. Postoperative Management :

a. Extubation :

When obese patients are fully recovered from the depressant effects of anesthetics, extubation is considered. Ideally, obese patients should recover in a head-up to sitting position. A history of OSA or obesity hypoventilation syndrome mandates intense postoperative monitoring to ensure maintenance of a patent upper airway and acceptable oxygenation and ventilation.

Anesthesia management :

3. Postoperative Management :

b. Transport :

Transport should occur with the patient awake, in a semi-upright position, and receiving supplemental oxygen.

Anesthesia management :

3. Postoperative Management :

c. Postoperative Analgesia :

Opioid depression of ventilation in obese patients is a concern, and the intramuscular route of administration may be unreliable owing to the unpredictable absorption of drugs. Patient-controlled analgesia or neuraxial opioids are commonly used.

Nonsteroidal anti-inflammatory agents may reduce narcotic requirements.

Anesthesia management :

3. Postoperative Management :

c. Postoperative Analgesia :

Intravenous acetaminophen has been recently approved by the FDA. Ketamine and Dexmedetomidine may be useful. Patients with OSA are at risk for development of postoperative hypoxemia. Adequacy of ventilation should be assessed for 24 to 48 hours postoperatively.

Anesthesia management :

3. Postoperative Management :

d. Respiratory Monitoring and Management :

Adequacy of ventilation should be assessed for 24 to 48 hours postoperatively. CPAP or BIPAP, if used at home, should be resumed.

e. Discharge to an Unmonitored Setting :

When pain is controlled and patient is no longer at significant risk of postoperative respiratory depression, he or she may be discharged to an unmonitored setting.

Anesthesia management :

3. Postoperative Management :

f. Postoperative Complications :

Wound infection is twice as common in obese as in nonobese patients. Mechanical ventilation may be required in patients who have a history of CO2 retention. Risks associated with OSA may extend for several days into the postoperative period. Likelihood of deep vein thrombosis and pulmonary embolism is increased.