Sedation for Obese Patients

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Abstract

Obesity has become a global health concern, with an increasing number of obese patients requiring procedural sedation in operating rooms, endoscopy suites, interventional radiology units, and ambulatory surgical centers. Sedation in obese individuals presents unique challenges due to altered respiratory physiology, difficult airway management, pharmacokinetic and pharmacodynamic changes, and a high prevalence of obesity-related comorbidities such as obstructive sleep apnea, obesity hypoventilation syndrome, cardiovascular disease, and diabetes mellitus. Sedation-related adverse events, particularly hypoxemia, airway obstruction, hypercapnia, and cardiovascular instability, occur more frequently in obese patients than in normal-weight individuals. Contemporary advances including capnography, high-flow nasal oxygen, continuous positive airway pressure, and dexmedetomidine-based sedation techniques have improved safety in high-risk populations. Appropriate preprocedural assessment, careful drug selection, optimized dosing strategies, vigilant monitoring, and advanced airway management techniques are essential to improve patient safety. This review summarizes the pathophysiological changes associated with obesity, discusses sedation-related risks, evaluates commonly used sedative agents, and provides evidence-based recommendations for peri-procedural management of obese patients undergoing sedation.

Keywords: airway management, capnography, obesity, obstructive sleep apnea, procedural sedation

Introduction

Obesity is defined by the World Health Organization as a body mass index (BMI) ≥30 kg/m² and affects more than one billion individuals worldwide. The prevalence of obesity continues to rise in both developed and developing countries, creating significant challenges for anesthesiologists and proceduralists. Many obese patients undergo procedures requiring moderate or deep sedation, including gastrointestinal endoscopy, bronchoscopy, interventional radiology, cardiac catheterization, dental procedures, and minor surgical procedures. Compared with normal-weight patients, obese individuals exhibit significant physiological alterations that increase the risk of sedation-related complications.[1,2]

Respiratory-related effects include reduced functional residual capacity (FRC), increased oxygen consumption, decreased respiratory compliance, and a higher prevalence of obstructive sleep apnea (OSA). Consequently, even brief periods of hypoventilation or airway obstruction can rapidly lead to severe hypoxemia. The pathophysiological changes relevant to sedation include reduced functional residual capacity, and FRC decreases progressively with increasing BMI due to increased abdominal pressure, reduced chest wall compliance, and diaphragmatic cephalad displacement. The reduction in FRC results in rapid oxygen desaturation, increased atelectasis formation, reduced oxygen reserve during apnea, and increased oxygen consumption. In addition, obese patients demonstrate higher metabolic demand, increased carbon dioxide production, greater ventilatory requirements. Consequently, oxygen desaturation occurs significantly faster during airway obstruction or apnea. OSA affects approximately 40-60% of obese patients, and up to 90% of patients with morbid obesity. Sedative drugs exacerbate upper airway collapsibility by reducing pharyngeal muscle tone, suppressing arousal responses, and impairing ventilatory drive.

For cardiovascular system, obesity is associated with hypertension, left ventricular hypertrophy, pulmonary hypertension, heart failure, and coronary artery disease. These conditions may increase susceptibility to hypotension, arrhythmias, and myocardial ischemia during sedation. Moreover, obese patients frequently exhibit gastroesophageal reflux disease, delayed gastric emptying, and increased intra-abdominal pressure. These factors increase aspiration risk during deep sedation.

Pre-sedation assessment

A thorough airway assessment is critical. The important predictors include Mallampati classification, neck circumference, and OSA. Higher Mallampati scores correlate with difficult mask ventilation, difficult intubation, and increased airway obstruction. Neck circumference >40 cm is associated with OSA and difficult airway management.[3-5] The STOP-BANG score is widely used for OSA screening. It consists of 8 parameters including S (snoring), T (tired), O (observed), P (pressure), B (body mass index), A (age), N (neck), and G (gender). These scores are divided into three-risk categories; low (0-2), intermediate (3-4), and high (≥ 5).[6] Importantly, obesity independently increases the risk of hypoxemia, airway interventions, and unplanned procedure interruption. High-risk patients require enhanced monitoring.

Sedative agents in obese patients

Propofol

Propofol has antiemetic, anxiolytic, hypnotic, amnestic and anesthetic properties, but it does not have analgesic effects. It is legally used by anesthesiologists and anesthetic personnel in many countries including Thailand. The advantages of propofol include rapid onset, rapid recovery, and easy titration. It does not significantly accumulate after repeated boluses. Propofol-based sedation is safe and highly

effective. The disadvantage of propofol is its narrow therapeutic range and risk of inadvertent general anesthesia. It can cause respiratory depression, airway obstruction, oxygen desaturation, and apnea especially after a rapid bolus. Mild respiratory adverse events occur frequently and major complications may happen rarely, but adverse events do not occur more frequently compared to other sedation regimens. In addition, hypotension a significant reduction in arterial blood pressure by decreasing systemic vascular resistance, preload and myocardial contractility. These effects are more prominent in patients with compromised cardiac function and the elderly patients. For induction, lean body weight is preferred. For maintenance, adjusted body weight may be appropriate. Excessive dosing based on total body weight may lead to overdose.[7]

Midazolam

Midazolam has the shortest half-life and duration of action, making it an ideal agent when prolonged sedation is not required. The advantages of midazolam include anxiolysis and amnesia. It should be used with caution in patients with respiratory conditions such as chronic obstructive pulmonary disease or obstructive sleep apnea. In addition, midazolam should be used cautiously in elderly patients as they typically have prolonged duration of effect. The disadvantages of midazolam are prolonged recovery, respiratory depression, and increased risk of postoperative airway obstruction. In obese patients, an accumulation may occur because of increased adipose tissue distribution.[7]

Dexmedetomidine

Dexmedetomidine has gained popularity for obese patients. It is a specific central 2 adrenergic agonist, and not associated with significant respiratory depression. Its properties of sedation, anxiolysis and analgesia together with its favorable pharmacokinetics make it a valuable adjunct for procedural and intensive care sedation. Dexmedetomidine induces a biphasic blood pressure response: high doses cause hypertension via a 2b-receptors on vascular smooth muscle, which precludes rapid intravenous injection. Lower doses cause hypotension and bradycardia by a centrally-mediated reduction in sympathetic activity. Dexmedetomidine does not appear to depress respiration. It may have some analgesic properties, probably with the spinal cord as its main site of analgesic action. The advantages of dexmedetomidine include minimal respiratory depression, cooperative sedation, and reduced opioid requirement. The disadvantages are bradycardia, hypotension, and longer onset time. Several studies suggest dexmedetomidine may reduce hypoxemic events compared with propofol-based sedation.[7,8]

Dexmedetomidine and propofol

The combination of dexmedetomidine and propofol is widely utilized in clinical practice for anesthesia, procedural sedation, and intensive care. It leverages the strengths of both drugs to achieve stable sedation while minimizing the adverse, dose-dependent side effects of either agent used alone. The benefits of this combination include lower propofol dose, improved respiratory profile, and enhanced

procedural conditions. It is particularly useful in endoscopy, bronchoscopy, and awake procedures. A previous study demonstrated this novel combination anesthetic regimen of dexmedetomidine and propofol during DISE leaded to increased procedural efficiency with preservation of vital sign stability.[9]

Ketamine

Ketamine is a neuroleptic anesthetic agent. It acts primarily as a noncompetitive N-methyl-d-aspartate (NMDA) receptor antagonist. It was originally used as a sole agent for anesthesia, inducing analgesia, amnesia, loss of consciousness, and immobility. Ketamine has demonstrated a wide margin of safety, with little risk of serious adverse effects. It has been shown to have beneficial cardiovascular effects when administered as maintenance sedation. Additionally, it offers a favorable hemodynamic profile and does not promote respiratory depression. However, it possesses some adverse psychological effects which occur during awakening from anesthesia. The advantages of ketamine include preserved airway reflexes, minimal respiratory depression, and bronchodilation. The disadvantages are emergence reactions, hypersalivation, and tachycardia. Ketamine is particularly useful in patients at high risk of respiratory compromise.[7,10]

Ketofol

Ketofol is a combination of ketamine and propofol. A combination of propofol and ketamine has several benefits in the terms of hemodynamic stability, absence of respiratory depression, post-operative analgesia and recovery. The safety and efficacy of ketofol as a sedative drug is depended on the dose and the ratio of the mixture. Ketamine-propofol combinations in the different ratios have been studied. A ratio is depending on procedural requirements. The advantages of ketofol are reduced propofol requirement, better hemodynamic stability, and less respiratory depression.[7,11]

Airway management during sedation

Patient positioning and head-elevated laryngoscopy position (HELP) are recommended for obese patients. The benefits of these positions include increased FRC, improved oxygenation, and better airway patency. In addition, reverse Trendelenburg position may further improve respiratory mechanics. For supplemental oxygen strategies, standard nasal cannula is useful for low-risk procedures but might be insufficient in severe obesity. High-flow nasal oxygen (HFNO) is endorsed in the severe obesity patients. The advantages of high flow nasal cannula (HFNC) include higher FiO_2 delivery, mild positive airway pressure, and reduced hypoxemia.[12] Several studies support HFNO during deep sedation in morbidly obese patients. Continuous positive airway pressure (CPAP) is particularly beneficial in patients with known OSA and obesity hypoventilation syndrome.

Monitoring

Standard ASA monitoring including electrocardiogram, noninvasive blood pressure, pulse oximetry, and capnography is recommended. Pulse oximetry is essential but may detect hypoventilation late. Capnography is especially valuable in obese patients. Current guidelines increasingly recommend capnography during moderate-to-deep sedation. Several benefits of this device include early apnea detection, earlier recognition of airway obstruction, and reduced severe hypoxemia. Capnography should be strongly considered mandatory for deep sedation, patients with BMI >35 kg/m^2, and OSA It detects hypoventilation, airway obstruction, and apnea earlier than pulse oximetry.[13,14]

Sedation for common procedures

Gastrointestinal endoscopy

Low-risk obesity patients, moderate sedation is utilized. Propofol and low-dose fentanyl is suggested. Morbid obesity patients, anesthesiologist-directed sedation is preferred. HFNC, capnography, and ramped positioning are recommended. Our previous study confirmed that propofol-based deep sedation for colonoscopy in marked obesity (BMI > 30) patients by trained anesthetic personnel with appropriate monitoring was relatively safe and effective. The complication rate of this technique in marked obesity patients was not different or worse than in non-obesity patients. Serious complications were rare.[15] In BMI >50 with severe OSA patients, general anesthesia and endotracheal intubation is considered instead of deep sedation.

Interventional radiology

The provision of adequate sedation and analgesia to patients undergoing invasive diagnostic or therapeutic procedures in the interventional radiology unit improves patient satisfaction and facilitates optimal patient care by reducing unwanted movement and stabilizing hemodynamic status.[16] These procedures are relatively long and limited airway access. They often require deep sedation and prolonged immobility. Continuous respiratory monitoring is mandatory. Generally, dexmedetomidine-based sedation, HFNC, and continuous $ETCO_2$ monitoring are recommended.

MRI sedation

Obesity complicates MRI sedation by significantly increasing the risk of respiratory depression, airway obstruction, and rapid oxygen desaturation. Moreover, the patients with a high BMI often require specialized airway management and close monitoring by an anesthesiologist, along with considerations for the physical limitations of the MRI scanner.[17] An ideal regimen is dexmedetomidine and low-dose ketamine. The advantages of this regimen include minimal respiratory depression and better image quality.

Dental sedation

Obesity and dental disease share common risk factors and so the demand for dental care for obese patients is escalating. There is a corresponding need to be able to provide

intravenous sedation safely when it is necessary and appropriate to do so. However, obesity often presents with multiple comorbidities and airway complexities, leading to more challenging management and potentially increased risk. Obese dental patients require careful airway assessment and conservative midazolam dosing. Enhanced monitoring is suggested because airway rescue may be difficult in the dental chair environment. Propofol remains the most common sedative agent. HFNO and capnography are increasingly recommended.

Bronchoscopy

A previous sedation study for bronchoscopy in obese patients demonstrated neither clinically significant differences in sedation needed nor increases in complications in obese versus non-obese patients using a variety of indices of obesity.[18] The challenges of bronchoscopy include shared airway, frequent coughing, and hypoxemia. Dexmedetomidine-based regimens may reduce respiratory complications.

Morbid obesity (BMI ≥40 kg/m²) substantially increases sedation-related risks. Common complications include difficult mask ventilation, airway obstruction, severe hypoxemia, and hypercapnia. Anesthesia consultation should be considered for patients with BMI >50 kg/m², severe OSA, significant cardiopulmonary disease, and anticipated difficult airway.[19]

Post–procedure management

Standard recovery room monitoring is utilized. The patients should observe longer if BMI >40 kg/m^2, OSA, opioid administration, and deep sedation. Common post-anesthesia care unit complications include airway obstruction, hypoventilation, hypercapnia, and delayed awakening.[20] The continuation of CPAP is permitted after sedation. Consequently, the obese patients using home CPAP should resume therapy as soon as achievable in the post-operative period.

Current recommendations

Several professional organizations highlight thorough airway assessment, OSA screening, weight-adjusted drug dosing, capnography during deep sedation, enhanced oxygenation strategies, and availability of advanced airway equipment. The trend toward increasing procedural sedation outside the operating room highlights the need for specialized training in managing obese patients. Emerging areas of research include artificial intelligence-assisted respiratory monitoring, closed-loop propofol delivery systems, novel sedative agents with minimal respiratory depression, expanded use of high-flow nasal oxygen, and personalized pharmacokinetic dosing models.

Conclusion

Sedation in obese patients presents significant clinical challenges because of altered respiratory physiology, increased airway vulnerability, and obesity-related comorbidities. Hypoxemia and airway obstruction remain the most common adverse events during procedural sedation. Safe sedation requires comprehensive preprocedural assessment,

individualized drug dosing, meticulous respiratory monitoring, appropriate patient positioning, and readiness for airway intervention. The integration of capnography, HFNO, and newer sedative strategies such as dexmedetomidine-based regimens may enhance patient safety and improve procedural outcomes. As obesity prevalence continues to rise globally, anesthesiologists and sedation providers must develop expertise in the unique peri-procedural management of this growing patient population.

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