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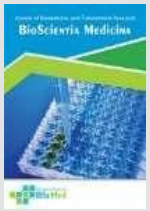

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Anesthesia Management in Morbidly Obese Patient Undergoing Neurosurgical Procedure: A Case Report

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A B S T R A C T

Background: Anesthesia management in morbidly obese patients undergoing any neurosurgical procedure is particularly challenging. This case report aims to further discuss the importances and concerns regarding the anesthesia management of decompression craniectomy in morbidly obese patients. **Case presentation:** A 46-years-old male patient was diagnosed with intracerebral hemorrhage on regio left external capsule due to hypertensive emergency suspected from Middle Cerebral Artery (MCA) aneurysma rupture. Decompression craniectomy with clot evacuation was planned. This patient has morbid obesity. Prediction of difficult intubation and mask ventilation can be assessed using LEMONS, MOANS, Mallampati score and STOP-Bang Questionnaire. The dosage of anesthetic agents used in these patients had been adjusted according to current recommendations. Intraoperatively, patient's hemodynamic was successfully maintained stable. Postoperatively, patient was closely monitored in the intensive care unit. **Conclusion:** It is imperative to acquire adequate knowledge on choosing the effective anesthetic management during the preoperative, intraoperative, and postoperative periods to achieve good outcome in morbidly obese patient undergoing neurosurgical procedures.

1. Introduction

Morbid obesity is defined as a body mass index (BMI) of 35 kg/m^2 or more. Anesthetic management in this condition is often associated with an increased risk of complications during preoperative, intraoperative, and postoperative periods. Progressive increases in BMI impair the function of most systemic organs.[1] Various pathological changes in the respiratory system, cardiovascular comorbidities, and metabolic diseases should be carefully assessed, as all these factors will affect the anesthesia process. Changes in several agents' pharmacokinetics and pharmacodynamics require dosage adjustment.[2] Here, we report a case of a morbidly obese patient diagnosed with intracerebral hemorrhage undergoing decompression craniectomy and clot evacuation. Neurosurgery in morbid obesity encounters many challenges for most anesthesiologists and needs more vigilant attention to ensure safe perioperative outcomes in these patients.

Anesthesia in morbidly obese patients undergoing any neurosurgical procedure is somehow particularly challenging. Therefore, it is imperative to acquire adequate knowledge for effective anesthetic management during the preoperative, intraoperative, and postoperative periods. The respiratory, cardiovascular, and gastrointestinal systems are the most common organs affected in obese individuals.

Excessive deposits of adipose tissue in the chest walls, ribs, diaphragm, and abdomen cause mechanical impairment of muscles in these areas. Lung compliance and lung volumes in these patients will subsequently be reduced. Increased neck circumference is associated with difficult airway management. Cardiovascular complications, including arrhythmia, hemodynamic changes, changes in autonomic tone, and thromboembolic events are often observed. Dyslipidemia puts obese patients at risk of developing hepatobiliary diseases that may impact drug metabolism and aggravate reflux and insulin resistance.[1]

2. Case Presentation

A 46-year-old male patient was referred from a regional general hospital with a chief complaint of unconsciousness prior to hospitalization. The patient was found confused and had slurred speech and weakness on the right side. The day before this incident happened, the patient was still able to perform the daily routine. Other significant symptoms, such as projectile vomiting, seizure, fever, shortness of breath, and head trauma, were denied. According to the family, the patient was often snoring and waking up several times at night. No other comorbidities reported, except a big posture from the youth's age. Patient was an active smoker. He was given tranexamic acid, citicoline, and paracetamol before referred to our centre.

On assessment, the patient had body weight of 200 kg, height of 180 cm, with measured BMI of 61,7 kg/m^2. The patient was soporous (Glasgow Coma Scale E2V2M5), with respiratory rate of 28/min, heart rate of 103/min, blood pressure of 209/105 mmHg and oxygen saturation of 90% on NRM 15 lpm. Physical examination was unremarkable. Patient's airway was assessed, he had LEMON score of 2/10 and MOANS score of 3/5. Sleep-disordered breathing using STOP-BANG questionnaire revealed score of 6/10. Therefore, he was predicted to have difficult ventilation.

A complete blood count examination revealed increased white blood cell counts (13,50 x 103/µL), and hemoglobin was within normal limits. Blood coagulation tests were unremarkable, with an International Normalised Ratio (INR) of 1,23. Other blood examinations, including liver function tests, renal function tests, and electrolytes, were all within normal limits. The random blood glucose level was 148 mg/dl. Quantitative C-reactive protein showed a marked increase of 14,80 mg/dL. Chest X-ray showed cardiomegaly with a Cardio-thoracic Ratio of 62% and pneumonia. From the echocardiography result, ejection fraction was normal with global normokinetic, with no other abnormalities in valves.

The patient was diagnosed with intracerebral hemorrhage regio left external capsule due to a hypertensive emergency suspected of middle cerebral artery (MCA) aneurysm rupture. Decompression craniectomy with clot evacuation was planned. He was concluded to have ASA physical status IV Emergency. Surgery would be done under general anesthesia with the addition of SCALP block. For preoperative blood components preparation, 3 bags of packed red cells were prepared.

Pre-medications were not given to our patient. He was put into a ramped position, and pre-oxygenation was done using 100% oxygen. We calculated the drug dosage using Lean Body Weight (LBW). We assumed 75 kg. Fentanyl of 300 mcg IV (3-5 mcg/kg LBW) was used as analgesia, anesthesia induction was done using Propofol 200 mg IV (2-3 mg/kg LBW), and intubation was facilitated using muscle relaxant, we used Rocuronium 80 mg IV (0,6-1,2 mg/kg LBW). Anesthesia was maintained using O_2: Compressed air, with Continous propofol infusion by 50-150 mcg/kgBW/min (total of 3400 mg), Fentanyl top-up intermittently 0,25 mcg/kgBW every 45 – 60 minutes IV (total of 300 mcg), and rocuronium of 0.2 mg/kgBW every 45 – 60 minutes IV (total of 220 mg). SCALP block was subsequently using plain bupivacaine 0,25% with a volume 2 ml at each point.

During the surgery, neuroanesthesia principles were performed, like airway, breathing, and

circulation, including intracranial pressure by stabilizing the systemic within the normal range of systolic blood pressure between 103 – 169 mmHg, diastolic blood pressure of 52 – 72 mmHg, heart rate of 74 – 89/mins, respiratory rate of 14-16/min and oxygen saturation of 89 – 92%. A total of 2,500 mL Ringer Fundin was given intraoperatively. The surgery lasted for 4 hours and 35 minutes. Total intraoperative blood loss was 750 mL, and urine output was documented at 150 mL. Postoperatively, the patient was admitted to intensive care unit and still with mechanically ventilated. For pain management, fentanyl 500 mcg dripped continuously for 24 hours, and intravenous paracetamol 1,000 mg every 8 hours given to the patient.

3. Discussion

In the preoperative period, prediction of difficult intubation and mask ventilation can be assessed using LEMONS, MOANS and Mallampati score. Additional questionnaire, STOP-BANG questionnaire, is required to assess prior history of obstructive sleep apnea, including snoring, tiredness, observed apnea, high blood pressure, BMI, age, neck circumference and male gender. Patients with higher score of STOP-BANG are increased risk of having obstructive sleep apnea (OSA).[3] Premedication drug given may improve satisfaction and prevent complications, such as post-surgical pain, anxiety, gastrointestinal disturbances and optimizing general well-being. Postoperative nausea and vomitting (PONV) is often observed in obese patients.[4] Study by Waheed et al. recommended to use two or three combination of receptor antagonists, for example, ondansentron combined with dexamethasone or haloperidol to prevent PONV. Combination therapy is considered effective to reduce nausea and pain intensity, morever morphine consumption in morbidly obese patients.[3]

Positioning a morbidly obese patient is challenging because improper position will cause pressure on abdominal contents, restriction of diaphragmatic movement, limited cardiac reserve, air embolism and many other serious complication.[5] Patient in our study was placed in ramped position. Studies have shown that ramped position will ease and improve laryngoscopic views. This position can be achieved by elevation of the shoulders and the head with either folded blankets, elevation pillows, or raising the head end of the operating table by 25^{o} till achieving alignment of the sternal notch and the external auditory meatus.[5,6] Pre-oxygenation is crucial in these patients due to the risk of desaturation, higher oxygen consumption, and reduced functional residual capacity. Pre-oxygenation, in this case, was done using 100% oxygen. However, if conventional mask devices still can't meet higher peak inspiratory flow demands in morbidly obese patients, the application of positive end-expiratory pressure should be considered.[7,8]

Excess fat affects the pharmacokinetics and pharmacodynamics of anesthetic agents. The principles of dosage adjustment are lipophilic agents are based on total body weight (TBW), while less lipophilic or hydrophilic agents are based on ideal body weight (IBW) and Lean body weight (LBW). In our patient, fentanyl was used as an analgesic agent, and induction of anesthesia was done using propofol. The hypnotic agent mostly used in obese patients is propofol. It has a rapid onset and recovery time. Due to its lipophilic properties, the volume of distribution and clearance increases linearly with body weight, which results in prolonged sedation and recovery time. Thus, to avoid overdose and adverse effects, dosage adjustment in morbidly obese patients should calculated using lean body weight instead of total body weight.[8] Opioids can be used as an additional sedative alternative. However, increased risk of hypoxia and upper airway obstruction should be considered. Fentanyl is one of the most commonly used opioids. It is highly lipophilic, making its clearance faster and higher volume of distribution in obese patients. Neuromuscular blockers are employed to facilitate and ease the intubation process. Neuromuscular blockers are polar and hydrophobic; therefore, these agents are not highly distributed in fat tissues. Rocuronium is classified as a non-depolarizing neuromuscular

blockers, it was used in our patient to facilitate intubation. Dosage adjustment of rocuronium should be based on total body weight or lean body weight compared to actual body weight to minimize adverse effects.[1,3]

The risk of fluid loss is increased in obese patients undergoing surgery due to evaporation, extravasations, and third-space loss. Some obese patients are often observed to have bias volume caused by preoperative fasting, diabetes induced forced urine output and use of antihypertensive drugs such as diuretics that may lead to postoperative renal failure. In this study, patient was given a total of 2,500 mL of Ringer Fundin intraoperatively. Intraoperative fluid therapy is needed to prevent acute tubular necrosis in the kidneys.[1] SCALP block was also performed in this study, it is widely used to reduce hemodynamic response and incisional pain during craniotomy procedure. In general, peripheral nerve blocks provide effective and additional control of postoperative pain with lower risks of complications. However, difficulties may be faced in doing such procedure in obese patients, such as hidden anatomic landmarks and relatively short needle.[7,10]

Eventually, monitoring during neurosurgical procedure is critical. During craniotomy, blood pressure should be monitored with an indwelling radial artery line because electrocardiography and non-invasive blood pressure might not be that reliable in obese patients. Intraoperative neurophysiological monitoring such as, Somatosensory evoked potentials (SSEPs) and Motor evoked potentials (MEPs) are currently recommended as standard of care for most neurosurgical procedures. Somatosensory response can be assessed at the patient's scalp, while intact MEP suggests functional integrity of pyramidal tract.[11] In our patient, we applied arterial line for invasive blood pressure monitoring.

In the post operative period, morbidly obese patients are recommended to be closely monitored in post-anesthesia care unit (PACU). Standard oxygen therapy in these patients is the use of CPAP or non-invasive positive pressure ventilation following extubation. These strategies are required to prevent lung collapse, ensure adequate ventilation and reduce the rate of complications, such as acute respiratory failure and pneumonia.[5] Obese patients are also at increased risk of requiring mechanical ventilation after surgery. Use of opioid analgesics such as fentanyl or morphine can be considered. Anticoagulants should be considered as obese patients have higher incidence of deep venous thrombosis and pulmonary embolus. Rhabdomyolysis occurs in some patients; thus patient should be monitored closely if any development of deep tissue pains observed. Anesthesiologists should ensure that patient's respiratory parameters have returned to normal and maintain well before one is able to be discharged.[1]

4. Conclusion

In conclusion, morbidly obese patients possess several risks of complications during the surgical and postsurgical periods. Adequate knowledge and close monitoring of the patient starting from preoperative, intraoperative, and postoperative periods are crucial. Careful assessment, proper positioning, dosage adjustment and intensive care admission should be performed to ensure patient's wellbeing.

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