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Challenges of Super-Super Obese Patient Presenting for Neurosurgery: A Case-Based Review

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Abstract

With the rising prevalence of extreme obesity, their perioperative neurosurgical management demands special attention. We report the case of an acromegalic male with a body mass index as high as 64.12 kg/m^2 who presented for craniotomy and resection of a pituitary tumor under general anesthesia. Through this report, we introduce the readers to this newer concept of the highest grade of obesity in the context of neurosurgery, explain the perioperative concerns, and reiterate the need for careful drug dosing, ventilation targets, positioning requirements, thorough cardiac and airway evaluation, and preparedness for adverse events. This report also highlights the fact that a well-planned and managed case can still turn out uneventful in the presence of multiple comorbidities like diabetes mellitus, adrenocortical insufficiency, hypothyroidism, and acromegaly. Advances in airway management, regional anesthesia, and perioperative point-of-care ultrasound have made it possible to formulate a safe anesthetic plan tailored to the patient's needs.

Keywords
- acromegaly
- anesthesia
- neurosurgery
- POCUS
- super-super obesity

Introduction

Super-super obesity is defined as a body mass index (BMI) of the patient greater than 60 kg/m^2.[1] The prevalence of severe obesity comprising super and super-super obesity has nearly doubled from 4.7 to 9.2%, suggesting an inevitable encounter of super-obese patients presenting for nonbariatric surgeries.[1] Their perioperative management has been reported earlier only in the context of bariatric surgeries.[2] Due to lifestyle changes, associated endocrine dysfunction, and Cushing's syndrome secondary to preoperative steroids, there is an increase in the number of super and super-super obese patients presenting for nonbariatric surgeries, including neurosurgery. Neurosurgical interventions necessitate precise patient positioning and prolonged surgical duration, both of which are complicated in super-super obese individuals due to their massive adipose tissue, altered anatomy, and compromised respiratory function. Here, we describe the anesthetic challenges of a super-super obese patient undergoing neurosurgery, which presented as a difficult airway shared with the surgeon's operating space and other implications significantly affecting their perioperative morbidity.

Case Report

A 25-year-old male patient weighing 168 kg, with a height of 162 cm and a BMI of 64.12 kg/m^2, presented for neurosurgery with a diagnosis of acromegaly. The patient was posted for right pterional craniotomy and excision of pituitary microadenoma via a trans-sylvian approach. The conventional endoscopic transnasal-transsphenoidal approach for pituitary surgery was not feasible in this patient due to inadequate pneumatization of the sphenoid sinus.

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On endocrine evaluation, elevated growth hormone (21 ng/mL), hypothyroidism (T3: 80 ng/dL; T4: 3 mcg/dL; thyroid stimulating hormone [TSH]: 9 mU/L), adrenal insufficiency (serum cortisol: 5 mcg/dL), and diabetes mellitus on oral hypoglycemic agents for 6 years with an HbA1C of 6.6% and fasting blood sugar (FBS) of 114 mg/dL on the day of surgery were observed.

Preoperative pulmonary function tests indicated a restrictive pattern (forced expiratory volume in 1 second [FEV_1]: 1.82 L; forced vital capacity [FVC]: 2.16 L; vital capacity [VC]: 2.6 L; total lung capacity [TLC]: 3.7 L) and snoring history, tired during the day, observed stop of breathing while sleeping, high blood pressure - BMI $>$ 35 kg/m^2 (or 30 kg/m^2), age $>$ 50 years, neck circumference $>$ 40 cm and male gender (STOP-BANG) score of 6 on nasal continuous positive airway pressure (CPAP) for obstructive sleep apnea. A difficult airway was anticipated in view of Mallampati grade III, super-super obesity, acromegaly, increased neck circumference greater than 21 inches, and limited thyromental distance less than 2 cm with a Southwick and Katz score of 2. Preoperatively, the patient was counseled for awake fiberoptic intubation (AFOI) due to an anticipated difficult airway. Premedication consisted of pantoprazole 40 mg, thyroxine 75 mcg, and prednisolone 20 mg on the day of the surgery; prior to induction, an airway ultrasound was performed to assess the laryngeal anatomy and estimation of endotracheal tube size based on glottic diameter, as acromegalics are prone to glottic stenosis and vocal cord thickening. Additionally, the residual gastric volume was measured (80 mL) in view of the super obesity.

The operating room (OR) was arranged to accommodate a super-super obese patient. The operating table in our OR had a maximum weight limit of 150 kg; thus, two operation tables were joined together, and the Mayfield clamp was latched onto one of the operating tables, as shown in ►**Figs. 1** and **2**. Based on the patient's anthropometry, ideal body weight (IBW) and lean body weight (LBW) were calculated, and anesthesia drugs were administered accordingly. The patient was placed in a ramped-up position and preoxygenated with a high-flow nasal cannula at 30 L/min with an inspired oxygen fraction of (FiO_2) of 1.0. AFOI was done with an 8.0-mm endotracheal tube, after performing ultrasound-guided airway blocks and using the "spray as you go technique" (SAYGO) technique. After confirming tube placement, anesthesia was induced with propofol 170 mg titrated to loss of verbal response, fentanyl 300 µg, and atracurium 30 mg. Mechanical ventilation was done in pressure control mode (FiO_2: 0.5; inspiratory pressure: 25 cm of H_2O; and inspiratory-to-expiratory time ratio = 1:2; and tidal volume of 450–500 mL), and the respiratory rate was adjusted to partial pressure of CO_2 (35–45 mm Hg) based on arterial blood gas monitoring and end-tidal CO_2 of between 30 and 40 mm Hg.

Fig. 1 The operating room arrangement with two operating tables joined in parallel to accommodate the super-super obese patient.

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Fig. 2 The patient's head fixed on the Mayfield clamp with the base fixed to one of the operating tables.

A central venous catheter in the right internal jugular vein and an arterial line in the left radial were inserted under ultrasound guidance. Intraoperatively, anesthesia was maintained with sevoflurane targeting a minimum alveolar concentration (MAC) of 0.8 to 1, fentanyl 1 to 2 µg/kg/h, and atracurium 0.3 mg/kg/h infusion. Depth of anesthesia (DOA) was monitored using the Bispectral Index (Medtronic, Minneapolis, MN, United States), which was maintained between 35 and 45. Intermittent pneumatic compression devices were applied to the lower limb to prevent deep vein thrombosis (DVT). Before surgery, the patient was placed in a 30-degree head-up position, and care was taken to move both operating tables simultaneously. Perioperative glycemic management used intravenous (IV) insulin infusion targeting a blood glucose of 140 to 180 mg/dL. The surgery was uneventful, and before extubation, an airway ultrasound and a formal cuff leak test were performed to rule out any laryngeal edema. Neuromuscular blockade was reversed, and the patient was extubated after achieving a train of four ratios of 0.9. Postoperatively, the patient received nasal CPAP (pressure support: 12 cm of H_2O; positive end-expiratory pressure [PEEP]: 6 cm H_2O) and could ambulate from the first postoperative day (POD) after surgery. Postoperative analgesia was provided with fentanyl using a patient-controlled analgesia (PCA) pump. Pharmacological DVT prophylaxis was initiated at 48 hours after imaging of the head. The patient was discharged from the hospital on POD 6 without any further complications.

Discussion

The challenges faced by anesthesiologists during the perioperative management of super-super obese patients include adequate preoperative preparation and counseling, optimized dosing of anesthetic agents, management of difficult airway, intraoperative positioning, ensuring adequate analgesia, and management of postoperative complications. Preoperative optimization of independent risk factors like impaired glucose tolerance and obstructive sleep apnea with pulmonary hypertension is prudent for better neurosurgical outcomes. Preoperative incentive spirometry and respiratory physiotherapy are the cornerstone in the respiratory preoperative optimization of these patients.[2] However, caution should be exercised while advising patients with signs of raised intracranial pressure (ICP). Premedication must include proton pump inhibitors, as obese patients have reduced gastric emptying. Preoperative assessment of gastric residual volume by ultrasound has been validated and would aid the anesthesiologist in preventing perioperative aspiration in superobese patients.[3]

Routine assessment of the airway using the Mallampati and upper lip bite tests are nonspecific in patients with underlying super-super obesity and acromegaly.[1,4] The Southwick and Katz scoring system provides a better guide in the assessment of the airway in these patients.[5] Moreover, acromegalics also present with difficult mask ventilation due to macroglossia, prognathism, and enlarged nose.[5] Additionally, there are numerous laryngeal manifestations of acromegaly varying from arthritis of cricoarytenoid joints to recurrent laryngeal nerve palsy.[5] In our case, we opted for AFOI with the SAYGO and airway blocks. Ultrasonography (USG) guided airway blocks are superior to conventional landmark techniques in these patients due to altered neck anatomy.[6] Lidocaine 2% was utilized for anesthetizing the airway as a randomized controlled trial (RCT) has found that 2% lidocaine provides better intubating conditions with lower plasma lidocaine levels compared to 4% for airway topicalization in morbidly obese patients.[7]

Due to the altered pharmacokinetics of anesthetic drugs in these patients, there is a high risk of overdosing, resulting in delayed awakening. This could result in unnecessary postoperative imaging and additional tests to rule out intracranial causes of delayed awakening in a patient posted for neurosurgery. Therefore, DOA monitors can be used to optimize anesthetic management. Moreover, the infusion of fentanyl needs to be calculated based on the LBW and atracurium according to the IBW.[8] The dosage calculation for most anesthesia drugs for administration in obese patients is based on the LBW, except nondepolarizing neuromuscular antagonists, which should be based on the IBW.[8] Patient positioning should be done with adequate padding of pressure points and with avoidance of extreme neck rotation. Super-super obese patients have a high risk of

major adverse cardiac events (MACE) in the perioperative period as they have a high incidence of heart failure with preserved ejection fraction.[9] The risk of MACE is further increased due to the presence of acromegaly.[5] Moreover, these patients are prone to cardiac arrhythmias secondary to heart–brain interaction, especially in tumors in the peri-hypothalamic region.[10]

Extubation should be attempted once the patient has complete recovery from the effect of anesthetics and muscle relaxants. Hence, DOA and neuromuscular monitoring plays a crucial role in decision-making. These patients are generally vulnerable to neuromuscular blockade, and the recovery of train of four (TOF) to 0.9 is significantly delayed as compared to normal patients.[8] Postoperative noninvasive ventilation (NIV) reduces the incidence of extubation failure and respiratory distress in these patients.[3] Adequate analgesia with PCA has been found to improve patient outcome with reduced complications in these patients.[1,3]

Conclusion

Adequate preoperative preparation, anticipation of problems, and preparedness to circumvent complications with a multidisciplinary team reduce the morbidity and mortality in superobese patients presenting for neurosurgery.

Conflict of Interest
None declared.

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