OBJECTIVES

At the end of this PBLD discussion, the participant will be able to

1. Discuss the preoperative evaluation for a morbidly obese patient undergoing thoracotomy
2. Develop a plan for airway management in a morbidly obese patient
3. Discuss strategies for lung isolation in morbidly obese patients
4. Present the rationale between choosing pressure control or volume control ventilation
5. Discuss pain management strategies for thoracotomy in morbidly obese patients
6. Discuss the postoperative management strategy for morbidly obese patients

CASE PRESENTATION

Mary is a 59 year-old, 125 kg, 160 cm (BMI ~ 50) Caucasian female presents for right thoracoscopic wedge resection. She was undergoing a work up for abdominal pain when it was discovered that she has multiple lung nodules. These nodules were monitored over time with CT scans and a nodule in the right lower lobe (RLL) has grown during that time. She was referred for possible biopsy of the lesion. She currently is asymptomatic.

She has no complaints today. Currently still smoking about 5-10 cigarettes per day but attempting to quit and currently using Wellbutrin. She denies any heart palpations, chest pain, dizziness, headaches or shortness of breath (SOB). She can climb a flight of stairs without difficulty. She states her weight has been stable and she denies any changes in bowel movements.

Medical history is significant for asthma controlled with prn use of inhalers about once a week, hypertension, hypertriglyceridemia, mild reflux, history of diverticulitis in 2011 and cervical cancer at age 27 requiring total abdominal hysterectomy and bilateral salpingo-oophorectomy.

On physical examination, the patient’s vital signs are as follows: temperature 36.1, pulse 83, blood pressure 135/83, SpO₂ 97% on room air. She is in no apparent distress. On airway exam she has normal dentition, Mallampatti grade II view, 2-finger-breath thyromental distance with restricted neck
extension because of the fat pad between her shoulders. Chest is clear to auscultation and heart sounds are normal with no murmur. The abdomen is soft, nondistended and nontender to deep palpation throughout. The patient has a well-healed low midline incision. She has scant lower extremity edema bilaterally.

Preoperative lab data include: Hb 14.2 gm/dL, Hct 43 %, platelets 391,000/ml, Na+ 137 mEQ/L, K+ 4.2 mEQ/L, Cl 106 mEQ/L, HCO3 22 mEQ/L, BUN 14 mg/dL, Cr 0.8 mg/dL, glucose 118 mg/dL, aPTT 27 seconds, PT 11 seconds, INR 1.0. The electrocardiogram shows sinus rhythm at 83 beats/min with one PVC noticed on the 12-lead EKG strip. The chest Xray shows clear lung fields with no pleural fluid or air demonstrated. The cardiomediasinal silhouette appears normal. Pulmonary function test shows an FVC of 3.22 Liters (94% of predicted), FEV1 1.43 Liters (52% of predicted), FEV1/FVC 44 %, FEF 25-75% 1.4 L/sec (50% of predicted), PEF 0.32 L/sec (35% of predicted).

QUESTIONS

1. On preoperative evaluation, how would you classify this patient’s perioperative risk?
2. What preoperative instructions would you give this patient?
3. How will you proceed with anesthetic induction and maintenance?
4. How would you approach airway management?

CASE CONTINUATION

The patient was premedicated with citric acid/sodium citrate 20 cc PO and brought to the operating room with a 20 gauge iv in her left hand. She was then placed in the supine position with a ramp under her upper body. Standard ASA monitors were initiated. Initial vital signs included HR 83 bpm, blood pressure 133/66 and SpO2 97% on room air. A rapid sequence induction was performed with preoxygenation, propofol 200 mg, fentanyl 200 mcg and rocuronium 70 mg. Direct laryngoscopy was performed with a Macintosh 3 blade, with a grade 1 view on the first attempt with external laryngeal manipulation.

QUESTIONS

1. Would you choose a double lumen tube (DLT), or a single lumen tube with a bronchial blocker?

CASE CONTINUATION

An 8 mm ID endotracheal tube was secured in place at 21 cm after confirmation of placement with capnography. A 9 Fr Fuji Bronchial Blocker was placed in the right main bronchus under bronchoscopic guidance. Anesthesia was maintained with oxygen, sevoflurane, fentanyl and rocuronium. A 16 gauge iv was then placed in the right forearm, and an intra-arterial catheter was inserted in the left radial artery for blood pressure monitoring. The patient was then turned to the left lateral decubitus position, with padding of all pressure points. The Fuji Blocker balloon position was confirmed by bronchoscopy. Prior to incision, the patient was disconnected from the ventilator and the right upper lobe was suctioned under direct vision by bronchoscopy. After the surgeon had opened the chest wall, the bronchial blocker
cuff was inflated to occlude the right mainstem bronchus and mechanical ventilation was resumed. Thirty minutes after one-lung ventilation (OLV) the SpO₂ decreased from 97% to 86%.

QUESTIONS

1. How would you manage hypoxia during OLV?
2. What mode of ventilation would you choose, and why?

CASE CONTINUATION

Mechanical ventilation was continued with pressure controlled ventilation in order to generate a tidal volume of 350 ml, respiratory rate 16/min, PEEP 5 cmH₂O and FiO₂ 100%. Peak inspiratory pressure was 25 cm H₂O and I:E ratio was 1:2. In addition, 5 cmH₂O of continuous positive airway pressure (CPAP) was applied to the non-dependent and collapsed lung for a short period of time (10 minutes), the SpO₂ increased to 98%. The rest of the surgery proceeded uneventfully. Intraoperative blood loss was 100 ml, and the patient received a total of 1000 ml in crystalloids. She was extubated at the end of the case and transferred to the postanesthesia care unit.

QUESTIONS

1. What would you prescribe for postoperative management for this patient?
2. How would you manage pain postoperatively?
3. Would you extubate the patient in the operating room?

CASE CONTINUATION

Incentive spirometry was encouraged, and the patient was able to inhale increasing volumes over the course of her postoperative stay. The patient reported minimal to no pain at rest or activity. Pain was managed with NSAIDs and opioids. She was mobilized postoperative day 1, with good results. She was discharged home on postoperative day 4.

DISCUSSION

The incidence of adult obesity (BMI > 30) has been rising in the United States, from about 10% in the 1960s to currently 30%. Of the adult population, 5% are considered morbidly obese (BMI >40). Greater numbers of morbidly obese patients are undergoing surgical procedures. These patients are at increased risk for various complications, leading to increased morbidity and mortality, prolonged hospital stay, and increased cost of care.

Obese, and morbidly obese, patients are at increased risk for difficult mask ventilation and difficult intubation secondary to excessive tissue in the posterior pharyngeal wall. The best predictors of obesity-related difficult airway include a Mallampatti score of III or IV, and increased neck circumference. Positioning the patient in a ramped-up position with elevation of the upper body allows for better airway access and visualization on laryngoscopy. An easily visualized parameter is to draw an imaginary
horizontal line that should connect the patient’s sternal notch with the external auditory meatus. This can be achieved with hospital linen stacked under the patient’s chest, shoulders and head (in increasing order), or with commercially available devices. Reverse Trendelenberg position also maximizes functional residual capacity by unloading the diaphragm.

Obese patients have typically been considered to be at high risk for aspiration pneumonitis. While rare, aspiration pneumonitis can result in devastating consequences. Rapid sequence intubation should be considered for morbidly obese patients, especially in the presence of reflux symptoms. However, the presence of a difficult airway might preclude rapid sequence induction. Awake fiberoptic intubation might be necessary if the airway is determined to be difficult.

Similar attention should be paid during extubation. The patient should be awake, with reversal of neuromuscular blockade and adequate analgesia, and placed in a reverse Trendelenberg position. The initial ease of mask ventilation and intubation, and the type of procedure, should be taken into account when formulating the extubation plan. Use of a single lumen tube allows for continuation of mechanical ventilation postoperatively without the need for airway exchange, though most thoracic surgery patients can be extubated on the operating table at the end of the procedure.

Morbidly obese patients are likely to have obstructive sleep apnea (OSA), even if they have not been formally diagnosed with a sleep study. Preoperative interview might elicit the common symptoms of OSA, including day-time drowsiness and tiredness, snoring, frequent awakenings and periods of apnea during sleep. The American Society of Anesthesiologists Task Force on Perioperative Management Practice Guidelines for the perioperative management of patients with OSA warns that judicious use of sedatives and opiates in the perioperative period is indicated in these patients. This caution should be extended to all morbidly obese patients because of the risk of over sedation and airway obstruction. Regional nerve and neuraxial blocks, along with nonsteroidal antiinflammatory drugs, help reduce the need for systemic opiates.

There is one report, Campos, et al comparing DLT with the Arndt blocker in morbidly obese patients undergoing OLV. These results showed that DLT and bronchial blockers present the same degree of difficulty at intubation. Once the device is properly placed the clinical performance is similar in morbidly obese patients; our clinical experience suggests that lung isolation can be achieved satisfactorily with both DLT’s and with bronchial blockers in these patients. If only a single lumen tube can be placed during laryngoscopy, but a DLT is absolutely necessary for the procedure, the single lumen tube can be exchanged over an airway exchange catheter to a DLT. This procedure should be done with help at hand, because of the potential for desaturation and airway loss. DLT size should be chosen based on airway evaluation on radiography rather than patient height or weight. Larger DLTs minimize airflow resistance during OLV. The advantage of a single-lumen tube plus a blocker is that if the patient requires mechanical ventilation in the postoperative period there is no need to exchange the tube.

Morbidly obese patients have reduced total lung capacity, reduced functional residual capacity and reduced vital capacity because of excess body fat, which decreases chest wall and diaphragmatic compliance. They are more prone to prolonged atelectasis postoperatively. Lung expansion interventions, namely incentive spirometry, deep breathing exercises, and continuous positive airway pressure have been shown to reduce pulmonary risk. Video-assisted thoracoscopic surgery (VATS) significantly reduces the risk of postoperative pneumonia and shortens length of stay compared to open thoracotomy.
Ventilatory strategy during OLV should take into account both pressure and volume. There is no proven benefit currently in choosing a pressure or volume-controlled strategy. High peak inspiratory pressures should be avoided secondary to restriction of chest wall and diaphragmatic excursion. Similarly, low tidal volumes can lead to worsening hypoxemia due to development of atelectasis. PEEP is beneficial in maintaining alveolar recruitment. Conversely, PEEP higher than the lower inflection point of the pressure-volume loop results in increased pulmonary vascular resistance, which then increases shunt fraction and hypoxemia. CPAP has been used on the non-dependent lung during OLV with good results. In our case, CPAP improved SpO₂ and allowed us to maintain oxygenation along with PEEP on the dependent lung.

Thoracic epidural analgesia has been shown to be superior to iv morphine in terms of analgesia, hospital length of stay. Paravertebral blocks provide a similarly superior option in managing postoperative pain, without the risk of epidural-related hypotension, nausea and vomiting. However, paravertebral blocks can be technically challenging in morbidly obese patients. Dexmedetomidine, an alpha-2 agonist, might provide analgesia without significant respiratory depression and may be useful in these patients.

Morbidly obese patients are at greater risk for systemic and pulmonary hypertension. Right ventricular dysfunction may be evident on echocardiography, especially in the presence of obstructive sleep apnea. These patients are also at increased perioperative cardiac risk because of their multiple comorbidities, in addition to potentially technically challenging surgery leading to prolonged surgeries with increased blood loss. Obese and morbidly obese patients are also at greater risk for deep venous thrombosis and pulmonary thromboembolism. Early mobilization and chemical thromboembolism prophylaxis is necessary to decrease this risk.

Additional issues with perioperative care of morbidly obese patients include glucose control in the setting of diabetes mellitus and surgical stress-induced hyperglycemia, care with intraoperative positioning to avoid thoracic or abdominal compression while still achieving good support and securement to the operating table, and difficulties with vascular access.

Alterations in pharmacokinetics and pharmacodynamics caused by obesity provide further challenges in the morbidly obese patients. Ideal body weight might serve as a better guide for drug dosing than actual body weight, though frequent titration is necessary to compensate for the increased volume of distribution.

In summary, a case of intraoperative hypoxemia in a morbidly obese patient was successfully managed.

REFERENCES


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