Anesthetic management for severe morbid obesity

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Abstract

A 44 year old woman weighing 220 kg with a height of 160 cm (BMI= 85.93) was planned to undergo stomach decreasing Roux-en-Y gastric bypass by general surgery department due to her morbid obesity. The anesthetic approach of morbid obesity surgery specific problems of patients concerning obesity should be investigated and optimized in preoperative and postoperative period.

INTRODUCTION

Morbid obesity is an important health problem with increasing incidence constantly. It leads to coronary artery disease, hypertension, dyslipidemia, diabetes mellitus, gallbladder disease, degenerative joint disease, obstructive sleep apnea, socioeconomic and psychosocial problems ([1]). The outcomes of these problems are closely associated with body mass index (BMI). Twenty five kg/m^2 and below is normal, 25-30 kg/m^2 has low risk, above 40 kg/m^2 is high risky and above 50 is considered as serious morbid obesity ([2]). Generally the most effective treatment (BMI>35) is bariatric surgery providing weight loss in the long term. Malabsorptive and restrictive approaches are designed in surgical treatment of obesity ([3,4]). Roux-en Y gastric bypass (RYGB) is the golden standard of bariatric surgery, combines gastric restriction with a minimal degree of malabsorption ([5,6]). RYGB is the most common bariatric surgical intervention. It helps losing weight for severe morbid obese cases within a short and long period. ([7]). Anesthetic management of morbid obesity carries features similar to its surgery. Preoperative evaluation is very important for the success of anesthetic intervention and safety of patient during bariatric surgery for severe morbid obesity. We aimed to introduce our perioperative experiences in severe morbid obese patient (BMI=86) in this article.

CASE REPORT

A 44 year old woman weighing 220 kg with a height of 160 cm (BMI= 85.93) was planned to undergo RYGB. Preoperative evaluation revealed that she was not able to lie on her back, she was sleeping in sitting position and she has hypertension, diabetes mellitus as well as she has limited effort capacity because of her obesity. Her blood pressure and blood glucose were within normal limits when she used anti-hypertensive agents and oral anti-diabetic drugs. Routine biochemical laboratory results were within normal limits. Lung function tests showed forced vital capacity (FVC), 77%; forced expiratory volume (FEV1) 82%; and FEV1/FVC,91% . She had respiratory distress in supine position on operating table due to her enormous breasts causing venous stasis together with neck pressure. This pressure was eliminated by plastering the breasts to her chest (figure 1). Her Mallampati score was class 3, she had short and thick neck (thyromental distance was 6 cm, sternomental distance 10 cm and neck circumference 48 cm) and her mouth opening was limited. Therefore, we took all necessary precautions due to possibility of difficult intubation. After a routine noninvasive monitorization, an 18-gauge peripheral cannula was placed on the top of her right hand. Following skin infiltration with 1% lidocaine and administration of 0.03 mg/kg midazolam for premedication, we inserted radial arterial catheter and subclavian venous catheter. Anesthesia was induced with fentanyl 2 mcg/kg, propofol 2mcg/kg and cisatracuronium 0.15 mg/kg. Endotracheal intubation was performed without any problem. After endotracheal intubation, anesthesia was maintained with an infusion of remifentanil 0.25mcg/kg/min, desflurane 4% end-tidal concentration and nitrous oxide in oxygen (Fi.O_2 0.5) and just before the end of the procedure metoclopramid was infused. Her arterial blood gas analysis, central venous pressure, urine outflow were followed during the operation. Operation procedure lasted 3.5 hours. At the end of the operation she was transferred to intensive care unit (ICU) as intubated because of the surgeons had difficulty in closing incision line and application of pressurized bandage. In the ICU, we applied 10 cm H_2O PEEP in Adopted Supportive Ventilation (ASV) mode (Galileo, Hamilton, Switzerland). She was extubated at third postoperative hour since she recovered spontaneous breathing and sufficient muscle strength. Respiratory physiotherapy was applied with hand respirometer after extubation and she was sent to her service the following day.

Figure 1

Figure 1: Patient's breasts plastered to her chest for eliminating the neck pressure

DISCUSSION

Systemic hypertension, pulmonary hypertension, left or right ventricular deficiency, ischemic heart disease and similar cardiac problems, dyspnea, ortopnea and similar respiratory signs and problems should be assessed and airways should be paid attention in the preoperative evaluation of morbid obese patients (8). Our case had diabetes mellitus hypertension but her arterial blood pressure and blood glucose level in normal levels with medical treatment. Because of limited effort capacity and respiratory distress in supine position we accomplished lung function tests. Baseline arterial blood gas measurements will help evaluate carbon dioxide retention and provide guidelines for perioperative oxygen administration and possible institution of and weaning from postoperative ventilation (9).

Peripheral and central venous access and arterial cannulation sites should be evaluated during the preoperative examination and the possibility of invasive monitoring should be discussed with the patient (9,10). Invasive arterial monitoring should be used for the severe morbid obese with cardiopulmonary disease and for those with inappropriate noninvasive blood pressure cuff (11). Central venous catheterization should be used in cases in which have cardiopulmonary disease and have problematic peripheral venous access (11). We placed an arterial and central venous catheter to measure invasive arterial blood pressure and to provide safe venous access.

During the premedication of these patients anxiolysis, analgesia and prophylaxis against aspiration pneumonia should be performed (9). Oral benzodiazepines are suitable for anxiolysis and sedation because they cause little or no respiratory depression. IV midazolam can also be titrated in small doses for anxiolysis during the immediate preoperative period. H_2- receptor antagonists and proton pump inhibitors reduce aspiration risk by reducing gastric volume and acidity (9). We sedated our patient with midazolam prior invasive monitorization. We also gave metoclopramid to prevent aspiration, postoperative nausea and vomiting.

Preparation should be made for the possibility of a difficult intubation (9,12). Brodsky et al. (13) used a logistic regression model to quantify the relationship between the ease of intubation and patient characteristics. They predicted that odds of a problematic intubation in a particular patient with a neck circumference 1 cm larger than of another patient are 1.13 times the odds the patient with a 1cm smaller neck circumference. Therefore, the probability of a problematic intubation was approximately 5% with a 40 cm neck circumference, compared with a 35% probability at 60 cm neck circumference (13). In our case although she had 48 cm neck circumference and the other difficult intubation criteria, we did not encounter any difficulties in intubation.

In addition to all these problems, calculating the dosage of anesthetic medication will be a problem for anesthetists. Because the recommended dosages of medications had been obtained after long term studies carried out on normal weight individuals. Obesity can change the pharmacokinetics and pharmacodynamics and may change the distribution and elimination of agents by affecting the function of organs (9). It is important to consider which weight should be used for medicines to be given to obese people (14). Most of the anesthetics are lipophilic agents. Highly lipophilic agents such as barbiturates and benzodiazepines, show increases in volume of distribution (V_D) for obese individuals (15,16,17). Remifentanil is a certain exception to this rule. There is no systemic relationship between its degree of lipophilicity and its distribution in obese individuals (16). Consequently, a lipophilic agent's doses should be calculated based on ideal body weight (IBW) (Table 1). There is a little change in V_D of weak lipophilic compounds. Therefore, these agents can be dosed based on lean body mass (LBM) or simply adding 20% to IBW will be more accurate (Table 1) (9,14). Nondepolarizing relaxants can be dosed in this manner (9,14). Midazolam has the increased central V_D in line with body weight but absolute dose has increased and larger initial doses are needed prolonged sedation may occur if applied without titration (9). Thus, we calculated the dose of midazolam by using this formula and administered it with titration. V_D and elimination half-life of fentanyl increases by severity of obesity (9). Therefore, we calculated the dose according to total body weight as recommended. One of our induction drug propofol show increase in V_D and have high affinity to fat tissue thus, we calculated the dose by IBW. We chose cisatracurium, as it is weak lipophilic muscle relaxant and have no change in V_D and elimination half-life (9). Dose of cisatracurium does not change per unit body weight without prolongation of recovery because of organ-independent elimination. Therefore, we administered cisatracurium according to TBW. Additionally we picked up remifentanil for the maintenance of anesthesia that have no systemic relationship between its degree of lipophilicity and its distribution in obese individuals (16).

Figure 2

Table 1: Body weight formulations

IBW	Height (cm) – χ^*
LBM	(1 - fat fraction) X weight
Fat Fraction	90 – 0.8 X (height / waist circumference) / 100

* χ value for women is 105 and for men 100

Because of inhaled anesthetics have high lipid/water partition coefficient they do not show a homogenous distribution in the body (18). They exist at higher concentration at lipid rich tissues than body fluids. Desflurane has been suggested as the inhaled anesthetic of chose in obese patient population because of its lower solubility at fat tissue and more rapid and consistent recovery profile (18,19). Rapid elimination and analgesic properties make nitrous oxide a good inhaled choose during bariatric surgery, but high oxygen demand in the obese patient limits its use (20). In our case, we used desflurane and nitrous oxide for the maintenance of anesthesia without any problem.

General anesthesia, even in healthy patients, increases intrapulmonary shunt, which impair pulmonary gas exchange (21,22). In morbidly obese patient undergoing general anesthesia, postoperative pulmonary complications are an important cause of postoperative morbidity and mortality (23). Atelectasis formation during general anesthesia is the main cause of the increase in intrapulmonary shunt (24,25,26). Pulmonary atelectasis occurs in 85%- 90% of healthy adults (27) within minutes after the induction of general anesthesia (28). The amount of atelectasis is larger in obese patients (29) or when a high fraction of inspired oxygen (FiO_2) is used (30). It has been reported that atelectasis develops in 45% of obese patients who had undergone upper abdominal surgery (31). Flier (23) reported that morbid obese patients have a risk of at least 29.3% to develop pneumonia and/or atelectasis. Furthermore, morbid obese patients will have oxygen desaturation more rapidly than nonobese patients during apnea (32). Moreover, this population of patients is at an increased risk of difficult intubation. Therefore, for morbidly obese patients, it would be particularly useful to prevent atelectasis formation during the induction of anesthesia despite the use of 100% oxygen (33). Initiation of continuous positive airway pressure (CPAP) treatment has been advocated (34,35). Coussa et al. (33) have applied 10 cmH_2O CPAP for 5 minutes before induction and 10 cmH_2O positive end expiratory pressure (PEEP) for 5 minutes after induction in their study. The same induction except CPAP and PEEP has also been applied to control group. Atelectasis determined by computed tomography. They have finally concluded that in morbid obese patients atelectasis formation is largely prevented by PEEP applied during the anesthetic induction and is associated with a better oxygenation (33). Noninvasive ventilation may be effective in preventing respiratory failure in severely obese patients when applied during the first 48 h post-extubation (36). Budweiser et al. (37) have reported that gas exchange and lung function in obesity-hypoventilation syndrome were improved after initiation of noninvasive positive pressure ventilation. They concluded that noninvasive ventilation was well tolerated and survival was excellent. We applied 10 cmH2O PEEP at

ASV mode during postoperative period at ICU and until extubation. Additionally we recommended that she use hand respirometer to prevent potential respiratory problems.

After a laparotomy for bariatric surgery, patients may avoid taking deep breaths because of pain. It is important to provide adequate analgesia to prevent respiratory problem ([38]). We gave tramadol with IV patient control analgesia device to our patient.

As a result, anesthetic management of these patients should take into consideration the specific problems associated with obesity and optimize them before surgery.

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