Post-operative Recovery of Morbidly Obese Patients under General Anaesthesia Using Desflurane versus Sevoflurane

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Abstract

Introduction: Laparoscopic sleeve gastrectomy (LSG) is commonly performed under general anaesthesia. LSG operation has become one of the most effective treatments of morbidly obese patients. There are several modalities of inducing and maintenance of general anaesthesia (GA).

Objectives: To compare the post-operative recovery of morbidly obese patient using desflurane versus sevoflurane with remifentanyl infusion as maintenance of anaesthesia.

Materials and Methods: This prospective randomized single-centre analytic study was carried out in Jaber Al Ahmed Armed Forces Hospital, Kuwait from July 2015 to July 2017. Total 60 morbidly obese patients (BMI >40 kg/m2) undergoing LSG under GA were randomly selected into two equal groups (Group-A and Group-B). Group-A received desflurane, Group-B received sevoflurane and both groups received remifentanyl infusion as maintenance of GA. To maintain hemodynamic stability and bispectral index score in the range of 40-60, using volatile anaesthetic either desflurane 2-6% or sevoflurane 1-2% with air and oxygen 50:50 during maintenance. Early recovery criteria were response to painful stimuli, obeying verbal command, spontaneous eye-opening, extubation time, handgrip, and orientation assessed by answering name and location. Intermediate recovery was assessed by modified Aldrete’s score at PACU.

Results: No significant differences in perioperative heart rate, systolic blood pressure, and diastolic blood pressure was found between two groups. Group-A patients had significantly faster eye-opening (9.7±4.3 vs 18.5±6.6), voluntary head rising on command (3.46±2.1 vs 7.38±4.52) shorter extubation time (12.2±8.1 vs 24.2±12), and orientation in time (16.2±8.2 vs 31.2±12.9) as compared to Group-B.

Conclusion: Volatile anaesthetic desflurane provided better post-operative recovery than sevoflurane in morbidly obese patients undergoing LSG with GA.

Key-words: Laparoscopic sleeve gastrectomy, General anaesthesia, Post-operative recovery, Modified Aldrete’s score.

Introduction

Obesity is defined as abnormal or excessive fat accumulation and body mass index (BMI) is the standard measure for describing different categories of obesity. World Health Organization (WHO) uses a class system to define obesity; BMI 30.0-34.9, 35.0-39.9 and >40 kg/m2 considered as obesity class 1, 2 and 3 respectively. BMI twice than normal that is >40 is considered as morbidly obese. Morbidity and mortality increase sharply when BMI is >40, particularly in smokers and risk is proportional to duration of obesity. The Prevalence of obesity continues to rise in both developed and developing countries and is associated with an increased incidence of a wide spectrum of medical and surgical pathologies. Approximately 7% of the world population (250 million) and 30% of North American people are obese. Morbid obesity is associated with various number of comorbidities such as hypertension, dyslipidemia, obesity-related diabetes, and respiratory conditions including asthma, pulmonary embolism, pneumonia, and obstructive sleep apnea.

Bariatric surgery is one of the most commonly performed surgical modality to weight loss for the treatment of morbid obesity. Laparoscopic bariatric surgery has the advantages of early mobilization and reduced hospital stay, but because of carbo-peritoneum may lead to intraoperative cardiovascular instability, neuroendocrine and renal changes. Aspiration and acute upper airway obstruction after tracheal extubation are the major risks of morbidly obese patients. Varieties of different anaesthetic technique in morbidly obese patients have been recommended. An ideal general anaesthetic for bariatric procedures should provide intraoperative hemodynamic stability and rapid recovery. Desflurane could be advantageous in obese patients because of its low solubility. There are some studies in healthy volunteers indicate that recovery from anaesthesia with desflurane proceeds nearly twice as with sevoflurane. To compare the post-operative recovery of morbidly obese patient using desflurane versus (vs) sevoflurane with remifentanyl infusion as maintenance of anaesthesia.

Materials and Methods

This prospective randomized single-centre analytic study was carried out at the Department of Anesthesia and Intensive Care in Jaber Al Ahmed Armed Forces Hospital, Kuwait from July 2015 to July 2017. Total 60 morbidly obese patients (BMI >40 kg/m2) undergoing LSG under GA were randomly selected into two equal groups (Group-A and Group-B). Group-A received desflurane, Group-B received sevoflurane and both groups received remifentanyl infusion as maintenance of anaesthesia.

References

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care unit in Jaber Al Ahmed Armed Forces Hospital, Kuwait from July 2015 to July 2017. Written informed consent was taken from all patients. A total of 60 morbidly obese patients (BMI>40 kg/m2), American society of anesthesiologist (ASA) grade I and II and aged between 25-45 years scheduled for LSG under GA were selected and divided randomly into two groups (Group-A and Group-B) containing 30 patients in each group. Group-A received desflurane and Group-B received sevoflurane with remifentanil infusion as maintenance of anaesthesia in both groups. Patients with ASA grade ≥ III, history of allergy to the study drugs, cardiovascular diseases, chronic obstructive lung diseases, hepatic dysfunction, renal dysfunction (serum creatinine>2mg/dl), susceptible to malignant hyperthermia (personal or family history), chronic alcohol or drug abuse, psychiatric or neurological disorder were excluded from the study.

Pre-operative investigations included complete blood count (CBC), urine examination blood sugar, serum electrolyte, coagulation indices, thyroid, liver, kidney and pulmonary function test, electrocardiography, and echocardiography as indicated. On the day before surgery preoperative anaesthetic assessment including detailed history and systemic examination relevant to obesity was performed. Airway examination was conducted to evaluate for possible difficult intubation. All patients were kept fasting for 12 hours prior to surgery and premedicated orally with omeprazole (20mg) and metoclopramide (10 mg) on night prior to surgery and repeated in the next morning. Anti-hypertensive and anti-thyroid medications were given to the patients in the morning of the day of surgery with little amount of water. After arrival of patient at the operating ward a wide bore intravenous catheter was inserted under local anaesthesia (LA). Standard monitoring was applied with a five lead electrocardiogram, non-invasive blood pressure, pulse oxymetry and capnography. The TOF-Guard neuromuscular motor, and electroencephalographic Bispectral index (BIS) monitor was applied and baseline value was obtained. Enoxaparin 40 mg was given subcutaneously as deep vein thrombosis prophylaxis one hour before the surgery.

All anaesthetic drugs during the procedure were administered as per requirement of body weight (BW). Before preoxygenation through 100% O₂ for 2 minutes by face mask, general anaesthesia was induced with intravenous injection of propofol 2 mg/kg and followed by fentanyl 1 μgm/kg of BW. Vecuronium bromide 0.1 mg/kg of BW was used to facilitate tracheal intubation. Ventilation was maintained with a mixture of O₂ and air 50:50 ratios with a fresh gas flow rate of 2L/min via close circle breathing system. Positive pressure ventilation was initiated and maintained with a tidal volume of 8 ml/kg of BW. To maintain End Tidal CO₂ 30-40% anaesthesia was maintained with 1 MAC (Minimum Alveolar Concentration) target concentration of desflurane in (Group-A) and sevoflurane in (Group-B). Remifentanil infusion was administered at 0.1-1 μgm/kg/min in both groups. BIS monitoring was used to provide adequate depth of anaesthesia. During the last 10 minutes of operation the inhalation agent decreased to 0.5 MAC. Tramadol 1 mg/kg was used for postoperative analgesia. Immediately after skin closure volatile anaesthetic administration was discontinued. At the end of surgery fresh gas flow rate was changed to 6L/min of 100% O₂ and neostigmine and glycopyrrolate were administered to antagonize the residual neuromuscular block. All patients were extubated when they were able to sustain spontaneous breathing with tidal volume >5ml/kg, train of four ratios higher than 0.9, ability to sustain a 5-sec head lift, an adequate negative inspiratory force (>40 cm H₂O), sustained handgrip and sustained arm lift. Early recovery was assessed by recording the time to return of consciousness and response to painful stimuli, time of response to verbal commands, spontaneous eye-opening, extubation time, handgrip, and stating name was recorded. Intermediate recovery was assessed by modified Aldrete’s score at PACU and compared between the two groups. (Table-I). Group-A patients had significantly (p<.05) quick response to painful stimuli (3.2±2 vs 7.4±4.2), voluntary head rising on verbal commands (3.46±2.1 vs 7.38±4.52), faster spontaneous eye-opening (9.7±4.3 vs 18.5±6.6), shorter extubation time (12.2±8.1 vs 24.2±12), quicker hand grip time (13.6±7.4 vs 22.3±11.4) and less time taken for stating name (16.2±8.2 vs 31.2±12.9) than Group-B patients (Table-II). Intermediate recovery was assessed by the modified Aldrete’s score at PACU and compared between the two groups on arrival, after 5 min and 10 min. The score was higher in Group-A than Group-B at all the occasions but this difference was not statistically significant (Table-III).

| Time in Minutes | Heart Rate (HR) | Systolic Blood Pressure (SBP) | Diastolic Blood Pressure (DBP) |
|----------------|----------------|-----------------------------|-------------------------------|
|               | Mean±SD        | Mean±SD                     | Mean±SD                       |
| Baseline      | 77.1±7.98      | 78.2±6.94                   | 140.4±10.22                   |
| 25            | 80.1±6.99      | 79.4±4.88                   | 130.2±21.34                   |
| 50            | 77.1±7.94      | 79.7±5.84                   | 135.9±17.02                   |
| 75            | 76.9±5.84      | 77.1±5.85                   | 128.2±17.88                   |
| 100           | 79.2±9.34      | 79.2±18.02                  | 120.3±14.27                   |
| 125           | 76.9±7.84      | 76.9±7.24                   | 122.8±14.20                   |
| 150           | 82.1±9.66      | 82.2±4.46                   | 134.1±13.02                   |
| 175           | 87.8±6.98      | 84.2±5.96                   | 149.0±9.02                    |

*p* test was done; for all the parameters mean difference between groups was not significant (p > 0.05)
Table-II: Patients recovery parameters

| Parameters                  | Time in minutes (Mean ± SD) |
|-----------------------------|----------------------------|
|                             | Group-A (n = 30) | Group-B (n = 30) |
| Response to painful stimuli | 3.2±2.0          | 7.74±4.2       |
| Obeying verbal commands     | 3.46±2.1         | 7.38±4.52      |
| Spontaneous eye opening     | 9.7±4.3          | 16.5±6.6       |
| Extubation time             | 12.2±8.1         | 24.2±12        |
| Hand grip                   | 13.6±7.4         | 22±11.4        |
| Stating name                | 16.2±8.2         | 31.2±12.9      |

*‘t’ test was done; for all the parameters time difference between groups was significant (p < 0.05)

Table-III: Modified Aldrete score at PACU

| Time in Minutes | Modified Aldrete Score (Mean ± SD) |
|-----------------|-----------------------------------|
|                 | Group-A (n = 30) | Group-B (n = 30) |
| At Arrival      | 7.44±1.23        | 7.13±0.92       |
| After 5 min     | 6.66±0.78        | 7.98±1.26       |
| After 10 min    | 9.48±0.61        | 9.03±1.02       |

*‘t’ test was done; mean modified Aldrete score difference between groups was not significant (p > 0.05)

Discussion

Morbidly obese patients are at increased risk for perioperative pulmonary complications, deep vein thrombosis, and pulmonary embolism. Also, carbon dioxide pneumoperitoneum can adversely affect respiratory mechanics by causing hypercarbia and elevated intra-abdominal pressure. The laparoscopic approach to bariatric surgical procedure is preferred to open bariatric procedure, as they are known to cause less morbidity and allows a much earlier return to normal activities. The newest volatile anaesthetics, desflurane and sevoflurane, have significantly lower blood/gas partition coefficient (0.45 and 0.65) than isoflurane (1.4) or halothane (2.4) predicting better intraoperative control and a more rapid recovery from anaesthesia. Our results are consistent with the prediction that lower solubility produces a more rapid recovery.

Eger et al. compared recovery characteristics in healthy male volunteers of normal weight. They found that response to command and orientation took about half the time after desflurane anaesthesia than after sevoflurane anaesthesia. One report has compared desflurane to another inhaled anaesthetics (isoflurane) for morbidly obese patients and found that desflurane anaesthesia was associated with a more rapid recovery. Nathanson et al. states that desflurane and sevoflurane have similar intraoperative conditions and numerous other reports indicate that recovery is more rapid with desflurane than that with other inhaled anaesthetics including isoflurane. One study comparing recovery characteristics of desflurane and sevoflurane in healthy male volunteers of normal weight, and they found earlier recovery after desflurane anaesthesia. Eger et al. showed that delayed recovery after sevoflurane anaesthesia because of its degradation products after prolonged anesthesia. Obese patients are particularly at risk of early postoperative respiratory complications. So, even slight improvements in early or intermediate recovery may be beneficial. Faster emergence, early extubation with a secure airway and maintenance of spontaneous ventilation leads to a reduction in the risk of development of complications and improve patient comfort.

Conclusion

In summary, it was found that both desflurane and sevoflurane provide similar intraoperative hemodynamics parameter. Desflurane has a better recovery profile than sevoflurane in morbidly obese patients undergoing LSG under GA.

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