Original Article

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

Alam MMU[1], Patwary A[2], Sultana MS[3], Nurunnabi M[4], Wahab MA[5]

DOI: https://doi.org/10.3329/jafmc.v14i2.45888

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-operativerecovery 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>40kg/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 receivedremifentanyl 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 airand 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'sscore at PACU.

Results: No significant differences in perioperative heart rate, systolic blood pressure, and diastolic blood pressurewas 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 anaestheticdesflurane 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 obesity1;BMI 30.0-34.9, 35.0-39.9 and>40 kg/m^2 considered as obesity class 1, 2 and 3 respectively[1]. 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[2]. 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[3]. Approximately 7% of the world population(250 million)[4] and 30% of North American people are obese[5,6]. 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[7,8].

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[9,10]. 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[11]. Desflurane could be advantageous in obese patients because of its low solubility[12]. There are some studies in healthy volunteers indicate that recovery from anaesthesia with desflurane proceeds nearly twice as with sevoflurane[13,14]. 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

1. **Lt Col Md Mahbub Ul Alam**, MBBS, DA, FCPS, Classified Specialist in Anaesthesiology, CMH, Sylhet (*E-mail:* alam100952@gmail.com) 2. **Dr Abhay Patwary**, MBBS, MD,Consultant Anaesthesiologist, Jaber Al Ahmed Armed Forces Hospital, Kuwait 3. **Lt Col Most. Sarmin Sultana**, MBBS, MCPS, FCPS, Associate Professor Biochemistry, AFMC, Dhaka 4. **Lt Col Md Nurunnabi**, MBBS, FCPS, Classified Specialist in Pathology, CMH, Sylhet 5. **Lt Col Md Abdul Wahab**, MBBS, MD, Associate Professor of Biochemistry, AFMC, Dhaka.

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 remifentanyl 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 assessmentincluding 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 surgeryandpremeditated 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 subcutaneouslyas deep vein thrombosis prophylaxis one hour before the surgery.

All anaesthetic drugs during the procedure were administered as per requirement of body weight (BW). After preoxygenation through 100% O_2 for 2 minutes by face mask, general anaesthesia was induced with intravenous injection of propofol 2 mg/kgand 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 O_2 and air 50:50 ratioswith 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 CO_2 30-40% anaesthesia was maintained with 1 MAC(Minimum Alveolar Concentration) target concentration of desflurane in (Group-A) of sevoflurane in (Group-B). Remifentanyl 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% O_2 and neostigmine and glycopyrrolate were administered to antagonize the residual neuromuscular block. All patients wereextubated 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, extubationtime,handgrip and stating namewas recorded. Intermediate recovery was assessed at PACU by modified Aldrete score15 on arrival, after 5 min and after 10 min.

All statistical analysis was performed using computer software SPSS version 17.0 for windows. Quantitative data were expressed as mean±SD andstudent's t-test was performed to compare means between groups and $p < 0.05$ considered as significant.

Results

Total of 60 patients'assessment was successfully completed as per protocol. The two groups were compared with haemodynamic parameter, the response to painful stimuli, time of response to verbal commands, spontaneous eye-opening, extubation time, handgrip, and stating name was recorded. No significant ($p>0.05$) differences in heart rate(HR), systolic blood pressure(SBP) and diastolic blood pressure(DBP) between two groups (Table-I). Group-A patients had significantly ($p<.05$) quick response to painful stimuli (3.2±2 vs 7.44±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 (12.22±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).

Table-I: Heart rate (HR), Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) of Patients

Time in Minutes	Heart Rate (Mean ± SD)		SBP (Mean ± SD)		DBP (Mean ± SD)	
	Group-A (n = 30)	Group-B (n = 30)	Group-A (n = 30)	Group-B (n = 30)	Group-A (n = 30)	Group-B (n = 30)
Baseline	77.18±7.98	78.72±9.94	140.44±10.22	142.22±10.44	85.88±6.45	76.12±7.91
25	80.12±9.69	79.44±6.88	130.22±16.34	120.92±16.01	82.28±8.46	80.02±8.34
50	77.12±7.94	79.77±7.84	135.96±17.02	131.82±17.82	78.20±8.93	77.76±6.45
75	76.56±8.44	77.12±7.66	126.22±17.88	123.7±13.02	77.44±10.47	77.86±9.43
100	79.22±9.34	79.22±8.02	120.36±14.27	128.02±15.43	75.54±8.46	78.98±9.13
125	76.96±7.84	76.94±7.24	122.38±14.20	126.8±12.22	74.46±8.78	79.12±6.01
150	82.12±9.66	82.24±6.46	134.12±13.02	124.6±9.66	83.27±9.33	78.91±5.01
175	87.84±6.98	84.22±5.96	149.66±9.02	130.76±7.25	87.66±5.88	79.22±4.09

**'t' 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	18.5±6.6
Extubation time	12.2±8.1	24.2±12
Hand grip	13.6±7.4	22.3±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	8.66±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[15,16]. 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 anesthesia[17,18]. Our results are consistent with the prediction that lower solubility produces a more rapid recovery.

Eger et al[13,14] 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[19]. Nathanson et al[20] 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 sevoflurane[21-23]. One study comparing recovery characteristics of desflurane and sevoflurane in healthy male volunteersof normal weight, and they found earlier recovery after desflurane anaesthesia. Eger EI et al showed that delayed recovery after sevoflurane anaesthesia because of its degradation productsafter prolonged anesthesia[24]. One study observed that faster washout and recovery times have been demonstrated with desflurane using inhalation bolus techniqueto optimize anaesthetic morbidly obese patient[25].

Obese patients are particularly at risk of early postoperative respiratory complications. So, even slight improvements in early or intermediate recovery may be benificial[25]. 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.

References

1. Public Health England. Measurment of Obesity 2014. http://www.noo.org.uk/NOO_about_obesity/measurement (accessed 08/01/2015).

2. Murphy PG, HemingsHC Jr, Hopkins PM. Obesity Foundations of Anaesthesia, Basic and Clinical Sciences, 2000 London. Mosby 2000:703-11.

3. Bjorntorp P. Visceral obesity: A "civilization syndrome". Obes Res 1993; 1:206-22.

4. World organization expert consultation. Appropriate body mass-index for Asian populationsand its implications for policy and interventions strategies. Lancet 2004; 363:157-63.

5. Mokdad AH, Serdula MK, Dietz WH et al. The continuing epidemic of obesity in the United States. JAMA 2000; 284:1650-1.

6. Kuczmarski RJ, Flegal KM, Campbell SM et al. Increasing prevalence of overweight among US adults. The National Health and Nutriton Examinations Surveys, 1960-1991. JAMA 1994; 272:205-11.

7. Bombelli M, Facchetti R, Sega R et al. Impact of body mass index and waist circumference on the long-term risk diabetes mellitus, hypertension, and cardiac organ damage. Hypertension 2011; 58:1029-35.

8. Ulric CS. Asthma symptoms in obese adults: The challenge of achieving asthma control. Expert revlin Pharmacol 2016; 9:5-8.

9. Passannante AN, Rock P. Anaesthetic management of patients with obesity and sleep apnea. Anesthesiol Clin North America 2005; 23:479-91.

10. Gerges FJ, Kanazi GE, Jabbour-Khoury SI. Anesthesia for laparoscopy: A review. J ClinAnesth 2006; 18:67-78.

11. Abernethy DR, Greenblatt DJ. Drug disposition in obese humans. An update.Clin Pharmacokinet 1986; 11:199-213.

12. La Colla L, AlbertinA, LaColla G et al. Faster wash –out and recovery for desfluranevssevoflurane in morbidly obese patients when no premedication is used. Br J Anaesth 2007; 99:353-8.

13. Eger EI II, Bowland T, Ionescu P et al. Recovery and kinetic characteristics of desflurane and sevoflurane in volunteers after 8- h exposure, including kinetics of degradation products. Anaesthesiology 1997; 87:517-26.

14. Eger EI II, Gong D, Koblin DD et al. Effect of anaesthetic duration on kinetic and recovery characteristics of desflurane vs. Sevoflurane (plus compound a) in volunteers. AnesthAnalg 1998; 86:414-21.

15. Alderet JA.The post anesthesia recovery scorerevisited. J ClinAnesth 1995; 7:89-91.

16. Rose DK, Cohen MM, Wigglesworth DF et al.Critical respiratory events in the post anesthesia care unit.Patient, surgical and anesthetic factors. Anesthesiology 1994; 81:410-8.

17. Wu EC, Barba CA. Current practices in the prophylaxis of venous thromboembolism in bariatric surgery. Obesity surgery 2000; 10(1):7-13.

18. Yasuda N, TargAG, Eger EI II.Solubility of 1-653 sevoflurane. Isoflurane, and halothen in human tissue.Anesth Analog 1989; 69:370-3.

19. Malviya S, Lerman J. The blood/ gas solubilitiesof sevoflurane, isoflurane, halothane and serum constituents concentration in neonates and adults. Anesthesiology 1990; 72:793-6.

20. Nathanson MH, Fedman B, Smith I et al. Sevoflurane verses desflurane for out patientanesthesia: A comparison of maintenance and recovery profiles. Anesth Analg 1995; 81:1186-90.

21. Juvin P, Vadam C, Malek L et al. Postoperative recovery after desflurane propofal orisoflurane anesthesia among morbidly obese patients: A prospective, randomized study. Anesth Analg 2000; 91:714-9.

22. Song D, Joshi GP, White PF. Fast-track eligibility after ambulatory anesthesia: Acompariison of desflurane, sevoflurane and propofal. Anesthanalg 1998; 86:267-73.

23. Beaussier M, Deriaz H, Abdelahim z et al. Comparative effects of desflurane and isofluraneon recovery after long lastinganesthesia. Can J Anaesth 1998; 45:429-34.

24. Eger EI, Bowland T, Ionesco Pet al. Recovery and kinetics charasteristics of desflurane and sevoflurane in volunteers after 8-h exposure, including kinetics of degradation products. Anesthesiology 1997; 87:517-26.

25. De Baerdmaeker LE, Struys MM, Jacobs Set al. Optimization of desflurane administration in morbidly obese patients: A comparison with sevoflurane using an inhalation bolus technique. Br J Anesth 2003; 91:638-50.