ORIGINAL ARTICLE

Comparison of Recovery Characteristics of Sevoflurane and Isoflurane in Obese patients

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ABSTARCT

Aim: To compare the recovery characteristics i.e.emergence time of sevoflurane and isoflurane in obese surgical patients.
Study design: Randomized control trial.
Place & Duration: Department of Anaesthesiolgy, DHQ hospital , Sargodha (Pakistan) and was completed in six months period from September 2012 to February 2013.
Methods: Following informed consent,90 obese (BMI>30Kg/m2) patients were randomly divided into two groups.Group-A received sevofluane and Group –B received isoflurane for maintenance of anaesthesia following thiopentone induction. The speed of recovery was measured by time to eye opening,time to follow simple commands and time to correctly giving own names and current location.
Results: The recovery time was faster in the sevoflurane group.Emergence time[mean time of eye opening (SD)=11.04+1.76 vs 13.04+1.82 min,Extubation time[mean time of sticking tongue out(SD)=13.00+1.55 vs 15.44+1.52 min] and orientation time[mean time of giving own name and current location(SD) =18.00+1.49 vs 20.13+1.45 min were much shorter in sevoflurane group as compared to isoflurane group.
Conclusions: Sevoflurane provides more rapid recovery than isoflurane in obese surgical patients undergoing surgery of intermediate duration(1-2 hour).

Keywords: Sevoflurane;isoflurane;obesity;recovery.

INTRODUCTION

Obesity is an important nutritional disorder with huge economic impacts on health care systems[1]. The prevalence of obesity is increasing at alarming rate, not only in the developed countries but also in the developing countries as a result of sedentary life style, atherogenic diet and susceptible genotype[2,3,4]. Due to this reason anesthetists are increasingly confronted with problems of anaesthetizing the obese patients. Obese patients present a significant challenge to the anesthetists due to technical problems, associated co-morbidities and physiological changes associated with obesity. Complete Knowledge of pathophysiological and pharmacological aspects of the obese patient´s condition is essential for their care during preoperative assessment, intra-operative management and, if necessary, postoperative intensive care[5,6].

Obesity is closely related with several co-morbidities like hypertension, diabetes, gastro Esophageal reflux disease, coronary heart disease, obstructed sleep apnea, osteoarthritis, cancers, stroke that have a pronounced effect on anesthetic management[7,8,9]. Obesity leads to increased anesthetic Complications due to these co-morbidities[10]. The types of anesthesia and anesthetics used in obese patients have a profound impact on perioperative period especially on post-operative recovery and respiratory failure during early post-operative period[11]. General anesthesia impairs pulmonary gas exchange because of atelectasis formation. General anesthesia induces pulmonary atelectasis both in non-obese and obese patients but atelectasis formation is more significant in obese patients because of several alterations of their respiratory mechanics (decreased chest wall and lung compliance, decreased functional residual capacity)[12]. So post-operative complications in early recovery peroid are more frequent in obese surgical patients due to more atelectasis during general anesthesia and pre-existing risk factors[13]. In obese surgical patients, a more rapid recovery from anesthesia is beneficial to insure rapid return of protective airway reflexes and respiratory derive in order to prevent these post operative pulmonary complications[14].

The perfect choice of anesthetic in obese patient remains questionable[15]. Inhaled volatile anesthetics are used commonly for maintenance of general anesthesia because of their ease of administration and predictable intraoperative and recovery

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characteristics. Maintenance of hemodynamic stability and early recovery is the most important part of anaesthetic management[16]. The Use of newer inhalational agents such as sevoflurane and desflurane is on the rise because of their favorable recovery characteristic as measured by emergence time, extubation time and orientation time[17]. However all volatile anesthetics have a tendency to get deposited in adipose tissue. Such deposition may result in delayed recovery from anaesthesia as this effect is magnified in obese patients due to more fat reserves. This delayed recovery is due to transfer of volatile agent from fat to adjacent highly perfused tissues (e.g., omental/mesenteric fat to intestine and liver)[14].

None of the currently available inhaled volatile anesthetic agents has all the properties of an ideal inhaled agents.[18] Sevoflurane is a rapid acting, fluorinated ether inhaled anesthetic agent. It has pharmacokinetic properties that favour rapid emergence from anaesthesia thus enhancing patient safety and comfort. It has a low blood gas solubility of 0.69[19]. The low blood gas partition coefficient of sevoflurane mainly imparts this quality and confers it to an ideal anesthetic agent[20].

Because of increased obesity related complications in early recovery period, I compared the recovery characteristics of sevoflurane with isoflurane in obese surgical patients in this study.

METHODOLOGY

After getting approval from DHQ Hospital ethical committee and informed written consent about the study procedure, the patients from general surgical departments of DHQ Hospital Sargodha, fulfilling the inclusion criteria were included in the study. By using random number table, the participants were assigned to receive either sevoflurane (group-A) or isoflurane (group-B) as their primary anesthetic agent. The subjects were not received any pre-medication before arriving in the operating room. All patients were monitored by continuous ECG(lead 2), an automated oscillometric blood pressure system, pulse oximeter and capnograph. General anesthesia was induced with thiopentone (4mg/kg) intravenously. Tracheal intubation was facilitated by succinylcholine (1.5mg/kg) intravenously. Anesthesia was maintained with 60% nitrous oxide in oxygen , predeterminedend-tidal concentration of either sevoflurane or isoflurane to obtain adequate surgical anesthesia and cardiovascular stability throughout the surgical procedure. Tidal volume of 6 ml/kg and ventilatory rate was adjusted to maintain an end-tidal Pco_2 of 30-35mmHg. Atracurium (0.5mg/kg) i.v. was given for muscle relaxation initially and than in incremental doses as per required for maintenance of muscle relaxation throughout the procedure. Nalbuphine(0.15mg/kg) i.v. was given as an analgesic. At the moment of last skin suture, nitrous oxide and volatile anesthetic were discontinued simultaneously with no tapering. Lungs were manually ventilated with 100% oxygen at fresh flow of 6 liters/min until spontaneous ventilation resumed. Atracurium was reversed with neostigmine (40µg/kg) i.v. and glycopyrolate (10µg/kg). The tracheal tube was removed when the extubation criteria was met. Recovery variables were recorded, as emergence time, extubation time and orientation time, in the proforma (attached).

Data obtained was entered into SPSS version 11.0. Mean and standard deviation were calculated for emergence time, age, body mass index and anesthetic duration. Confounding variables like duration of anesthesia and body mass index were controlled by applying multivariate analysis of variance. Recovery variable i.e. emergence time was compared in both groups. T-test was test of significance with $p \leq 0.05$ as level of significance.

RESULTS

90 obese patients participated in this study; 45 received sevoflurane and 45 received isoflurane as a maintenance anesthetic. The two groups were comparable with respect to age, body mass index and duration of anesthetic exposure (Table 1).Recovery from anesthesia, as determined by eye opening either spontaneously or in response to vocal request (Emergence time),time to tracheal extubation after discontinuation of anesthetic agents and demonstration of appropriate orientation were significantly shorter in patients given sevoflurane than in patients given isoflurane inspite of comparable anesthetic duration (Table 2).The mean emergence time was 13.04±1.82 min for isoflurane and 11.04± 1.76 min in sevoflurane group. The mean extubation time was 15.44±1.52 min for isoflurane and 13.00±1.55 min in sevoflurane group.The mean orientation time was 20.13±1.45 min in isoflurane group and 18.00±1.49 min in sevoflurane group.

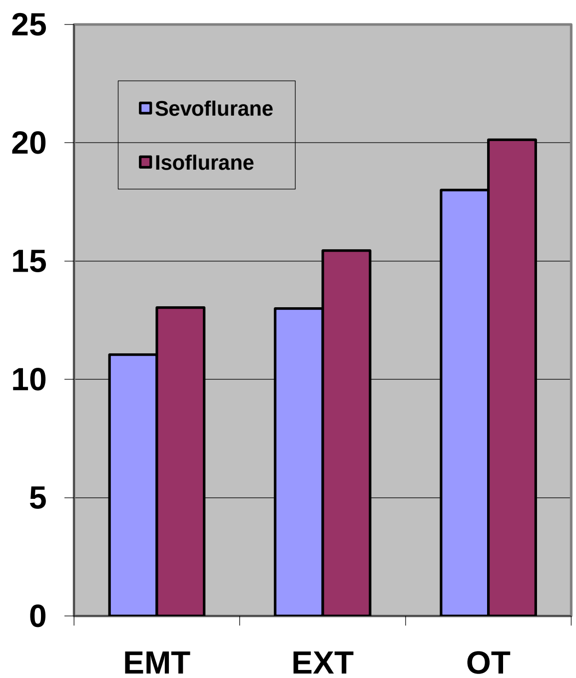
Table 1**.** Demographic and intraoperative data

Variable	Sevoflurane (n=45)	Isoflurane (n=45)	P value
Age(Year)	43.47 ± 9.38	42.84 ± 10.14	0.763
Gender (M/F)	8/37	11/34	NS
BMI(Kg/m2)	36.87 ± 3.67	35.96 ± 3.87	0.255
Duration of anesthesia(min.)	85.98 ± 15.56	83.89 ±14.81	0.516

Table 2: Recovery data (min)

Variable	Sevoflurane (n=45)	Isoflurane (n=45)	P value
Emergence time (minutes)	11.04 ± 1.76	13.04 ± 1.82	.000
Extubation time (minutes)	13.00 ± 1.55	15.44 ± 1.52	.000
Orientation time(minutes)	18.00 ± 1.49	20.13 ± 1.45	.000

Fig 1: Mean values of recovery characteristics in sevoflurane and isoflurane groups.



EMT: Emergence time , **EXT:** Extubation time
OT: Orientation time

DISSCUSSION

Induction and maintenance of general anesthesia is often managed with an inhaled anesthetic, which should provide rapid, smooth induction and emergence, hemodynamic stability, analgesia and amnesia. As might be predicted from its lower blood/gas solubility, my study demonstrated that obese patients anaesthetized for surgery of intermediate duration (1-2 hour) recovered significantly more rapidly after sevoflurane anesthesia than after isoflurane anesthesia. Patients who received sevoflurane left the operation theatre earlier than those given isoflurane. In comparing sevoflurane and isoflurane in a younger, healthier population, Frink et al. demonstrated that emergence time from sevoflurane-O_2 is almost half as compared to isoflurane-O_2 anesthesia (7.5±0.5 min versus 18.6±2.0 min). He also showed that emergence from sevoflurane was independent of duration of anesthesia but there is positive correlation between duration of anesthesia exposure and emergence times with isoflurane.[21] Gauthier A et al also showed that sevofl urane provides faster recovery than isoflurane for patients undergoing long duration neurological surgery (3-6 hour).The mean emergence time was 20.8±10.1 for isoflurane and 15.0±8.7 for sevoflurane. The magnitude of the differences between the two groups for most recovery end points is greater than what is reported for anesthesia of shorter duration[22]. But in another study Chiu CL and his colleagues showed a surprising fact that recovery time from sevoflurane anesthesia was longer than with isoflurane in short duration procedures (20 minutes). They postulated that although the rapid recovery is partly due to low blood gas partition coefficient but the solubility of volatile anesthetics in the tissue especially in the brain is also an important factor for rapid recovery in surgical procedures of short duration[19]. This is in contrast to previous studies comparing isoflurane anesthesia with sevoflurane anesthesia all of which showed a faster recovery with sevoflurane anaesthesia[23,24]. The results of our study are consistent with those found by Frink at al who compared the recovery of sevoflurane and isoflurane in normal healthy patients. Combell C and colleagues also demonstrated that recovery is more rapid after discontinuation of sevoflurane-nitrous oxide (9.9 +/- 1.1 min) than after isoflurane-nitrous oxide (13.9+/-1.3min) for surgical procedures of intermediate duration. Furthermore, a positive correlation was found between total anesthetic exposure or dose (MAC hours) and emergence time in the sevoflurane group(r=0.517, p=0.028) but not in the sevoflurane group[25]. Our study also favoured the results of Gauthier A who compared the recovery of sevoflurane and isoflurane in long duration neurological surgery. But the study by Dupont J et al suggested that there is no statistically significant difference in emergence time between sevoflurane and isoflurane in patients undergoing pulmonary surgery of long duration[26]. A meta-analysis examined the recovery profiles of adult patients and compared the maintenance of general anaesthesia with sevoflurane, isoflurane and propofol .The analysis considered 13 randomized controlled trials (RCTs) comparing sevoflurane with isoflurane and seven similar studies comparing sevoflurane with propofol. There were statistically significant reduction in times to recovery variables with the use of sevoflurane compared to isoflurane and propofol[27].

When evaluating the effects of duration of anesthesia on recovery endpoints, several interesting outcomes were noted. First, in cases less than 1 hr in duration, there were no differences between sevoflurane and isoflurane in any recovery endpoint. This contrasts to results of a multicenter study of sevoflurane versus isoflurane in ambulatory anesthesia in which case durations averaged 38-46 min[28]. The authors showed a 2-min faster time to emergence and a 3-min faster time to orientation with sevoflurane. Because the range of case durations was from 7 to 207 min, it is possible that including cases that lasted for more than 1 hr helped to achieve a statistical difference. It seems more likely that after short-duration anesthetic exposures, a minimal difference in recovery would exist between any of the volatile anesthetics because there would be little time to saturate tissue groups. The difficulty in showing a more rapid recovery with sevoflurane after short durations of anesthesia also may be explained, in part, by the identical alveolar elimination of sevoflurane and isoflurane after short-duration exposures in volunteers[29].

In contrast, patients receiving isoflurane showed progressive lengthening of times to early recovery endpoints with increasing case duration. The lack of an effect of duration of anesthetic exposure with sevoflurane on the times to early recovery end points is consistent with a previous study by Frink et al that compared sevoflurane to isoflurane in patients and also is consistent with a study by Campell C et al.

CONCLUSION

Low solubility volatile anesthetic sevoflurane resulted in faster recovery than isoflurane in obese surgical patients undergoing surgery of intermediate duration.

REFERENCES

1. Mokdad AH, Bowman BA, Ford ES The continuing epidemics of obesity and diabetes in United States. JAMA2001; 286: 1195 -1200
2. Islam N. Obesity: An epidemic of the 21st century. Pak Med Assoc 2005; 55:118-22.
3. Afzil N, Naveed M. Childhood obesity and Pakistan.J Coll Physicians Surg Pak 2004; 14:189-92.
4. Von Ungern- Sternberg BS, Regli A, Reber A, Schneider MC. Effect of obesity and thoracic epidural analgesia on perioperative spirometry.Br J Anaesth 2005;94:121-7
5. Saravanakumar K, Rao1 SG , Cooper GM. Obesity and obstetric anaesthesia. Anaesthesia, 2006; 61: 36–48
6. Adams JP, Murphy PG. Obesity in anaesthesia and intensive care. Br J Anaesth 2000; 85:91-108
7. Kiyani KA, Ahmed SI, Saeed A, Rashid R, Abrar K. Evaluation of obesity with identification of comorbidities and risk ststus. J Rawal Med Coll 2002; 6:82-90.
8. Bilal N, Akbar N, Khan AB. Obesity is a gateway to complications. Ann Pak Inst Med Sci 2005; 1:230-3.
9. Hofer RE, Sprung J, Sarr MG , Wedal DJ. Anesthesia for a patient with morbid obesity using dexmedetomidine without narcotics. Can J Anesth2005; 52:76-80.
10. Ogunnaike BO, Jones SB et al. Anesthetic considerations for bariartric surgery. Anesth Analg 2002; 95: 1793–1805
11. Gaszynski T. Anesthetic complications of gross obesity.Curr Opin Anesthesiol 2004; 17:271-6
12. Eichenberger AS, Proietti S, Wicky S, Frascarolo P, Suter M, Spahn DR, Magnusson L. Morbid Obesity and Postoperative Pulmonary Atelectasis: An Underestimated Problem .Anesth Analg 2002;95:1788-92
13. Dossett LA , Heffernan D, Lightfoot M, BS, Collier B, Diaz JJ, Sawyer R. Obesity and Pulmonary Complications in Critically Injured Adults.Chest 2008; 134:974-80
14. Strum EM, Zenohradszki JS, Kaufman WA, Anthone GJ, Manz IL, Lumb PD. Emergency and recovery characteristics of desflurane versus sevoflurane in morbidly obese surgical adult patients.Anesth Analg 2004;99:1848-53.
15. Ebert TJ, Arain SR. Recovery from sevoflurane vs desflurane anesthesia in morbidly obesity.Anesthesiology 2003; 99:A486
16. Gergin S, Cevik B, Yildrim GB, Ciplakligil E, Colakoglu S. Sevoflurane vs Desflurane;Haemodynamic parameters and recovery characteristics. The internet journal of anesthesiology 2005; 9:1
17. Jopal A and Gul N. Comparison of the arterial blood gas,arterial oxyhaemoglobin saturation and end-tidal carbondioxide tension during sevoflurane or isoflurane anesthesia in rabbits. Ir Vet J 2006; 59:278-81
18. Loscar M, Conzen P. Volatile anesthetics. Anaesthesist 2004; 53:183-98
19. Chiu CL, Chan YK, Ong GS, Delilkan AE. A comparison of the maintenance and recovery characteristics of sevoflurane-nitrous oxide against isoflurane-nitrous oxide anaesthesia. Singapore Med J 2000; 41:530-3
20. Yogendran S, Prabhu A, Hendy A, Mcguire G, Imarengiaye C, Wong J, chung F. Vital capacity and patient controlled sevoflurane inhalation result in similar induction characteristics. Can J Anesth 2005; 52:45-9.
21. Frink EJ Jr, Malan TP, Atlas M, Dominguez LM, Dinardo JA, Brown BR Jr. Clinical comparison of sevoflurane and isoflurane in healthy patients. Anesth Analg 1992; 74:241-5
22. Gauthier A, Girasd F, Boudreault D, MoniquiRuel , Jodorov A. Sevoflurane provide faster recovery and postoperative neurological assessmeny than isoflurane in long duration neurosurgical cases. Anesth Analg 2002; 95:1384-8
23. Ghatge S, Lee J Sevoflurane: an ideal agent for adult day-case anesthesia.Acta Anaesthesiol Scand. 2003; 47:917-31
24. Elbert TJ, Robinson BJ, Uhrich TD, Mackanthun A. Recovery from sevoflurane anaesthesia:A comparison to isoflurane and propofol anaesthesia. Anesthesiology 1998; 899:1524
25. Campbell C, Nahrwold ML, Miller DD.Clinical comparison of sevoflurane and isoflurane when administered with nitrous oxide for surgical procedures of intermediate duration.Can J Anaesth. 1995; 42:884-90.
26. Dupont J, Tavernier B, Ghosez Y, Durinck L, Thevenot A,Moktadir-Chalons N et al. Recovery after anesthesia for pulmonary surgery:Desflurane,sevoflurane and isoflurane.Br J Anaesth 1999;82:355-9
27. Robinson BJ, Uhrich TD, Ebert TJ. A review of recovery from sevoflurane anaesthesia: Comparisons with isoflurane and propofol including meta-analysis. Acta Anaethesiol Scand 1999; 43: 185-90
28. Philip BK, Kallar SK, Bogetz MS, Scheller MS, Wetchler BV, Sevoflurane Multicenter Ambulatory Group: A multicenter comparison of maintenance and recovery with sevoflurane or isoflurane for adult ambulatory anesthesia. Anesth Analg 1996; 83:314-9
29. Yasuda N, Lockhart SH, Eger EI II, Weiskopf RB, Liu J, Laster M, Taheri S, Peterson NA: Comparison of kinetics of sevoflurane and isoflurane in humans. Anesth Analg 1991; 72:316-24