



COMPARISON OF RECOVERY CHARACTERISTICS OF DESFLURANE VERSUS SEVOFLURANE IN LAPAROSCOPIC BARIATRIC SURGERIES UNDER GENERAL ANESTHESIA

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Article History: Received: 12.12.2022

Revised: 29.01.2023

Accepted: 15.03.2023

Abstract

Background: The maintenance of general anaesthesia involves the administration of inhalational anaesthetic drugs. Since both sevoflurane and desflurane possess the qualities of an ideal agent, they have been used for ambulatory anaesthesia.

Objectives: To compare the recovery properties of sevoflurane versus desflurane used during general anaesthesia for laparoscopic bariatric surgeries.

Material and methods: The current randomised control study was conducted on 60 adult patients of either gender at Sri Aurobindo Medical College and PG Institute in Indore (MP), belonging to ASA grades II and III, with a BMI of 35 or higher, scheduled for elective laparoscopic bariatric surgery using a standardised general anaesthesia technique. By comparing spontaneous eye opening, reaction to painful stimuli, and following vocal commands, researchers were able to analyse the patients' recovery profiles.

Results: Higher mean reaction time to painful stimuli. Spontaneous eye opening and obeying verbal commands was seen in Sevoflurane group in comparison to Desflurane group.

Conclusion: When compared to sevoflurane, desflurane is associated with faster and better recovery.

Keywords: Anesthesia, morbidly obese, sevoflurane, desflurane,

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DOI: 10.31838/ecb/2023.12.s2.065

1. Introduction

Numerous operations are carried out on obese patients as part of bariatric (weight loss) or metabolic surgery. Weight loss can be accomplished by utilising a gastric band, having part of the stomach removed (sleeve gastrectomy, biliopancreatic diversion with duodenal switch), or resecting and diverting the small intestine to a tiny stomach pouch (gastric bypass surgery). Laparoscopic bariatric surgeries or metabolic surgeries are performed under general anaesthesia. For maintenance of anaesthesia, various anaesthetic agents are used along with muscle relaxants. For bariatric surgeries, the optimum general anaesthetic should offer stable intraoperative hemodynamics and quick recovery. All volatile anaesthetics build up in skeletal muscles and adipose tissue over time. Such a buildup might make it harder to recover from anaesthesia. Anaesthetics that have been stored in fat may have an effect by returning to the blood that is perfusing the fat or by moving from the fat to nearby highly perfused tissues (for example, omental/mesenteric fat to the colon and liver). Sevoflurane and desflurane, two inhaled anaesthetics that share the benefit of rapid anaesthesia onset and offset compared to previous inhaled anaesthetics like halothane, ether, and also isoflurane, have low blood:gas partition coefficients. Patients who are extremely obese may experience an exacerbated effect of these characteristics, especially after receiving prolonged anaesthesia. Halogenated ether sevoflurane is a volatile anaesthetic substance. Quick induction is made possible by the low blood:gas partition (0.65 blood:gas partition coefficient and 48 fat:blood solubility at 37°C).³ Halogenated ether also includes desflurane. Desflurane has a short induction and recovery due to its low blood:gas partition coefficient of 0.42 and low fat:blood solubility of 27 at 37 °C.⁴ Since both Sevoflurane and Desflurane possess the qualities of an ideal agent, they have been used for mobile anaesthesia. Desflurane has a faster induction and emergence from anaesthesia than sevoflurane because it is less soluble in blood gases.⁵ However, desflurane has a strong flavour and might irritate the airway, causing coughing, laryngospasm, and profuse secretions.⁶ The present study was aimed at comparing the recovery characteristics of sevoflurane versus desflurane under general anaesthesia for laparoscopic bariatric surgeries.

2. Material and methods

The study was conducted in a randomised manner at Sri Aurobindo Medical College and PG Institute, Indore (MP), on a total of 60 adult patients of either gender belonging to ASA grades II and III, with

BMI equal to or above 35, scheduled for elective laparoscopic bariatric surgery using a standardised general anaesthesia technique, after receiving approval from the Institutional Ethical Research Committee and written informed consent from the patient. The patients, who were divided into two groups of 30 each using a computer-generated random numbers table, were given desflurane or sevoflurane as maintenance of anaesthesia. Pregnancy or nursing, history of drug use, coronary artery disease, or a myocardial infarction were all excluded.

A day before the procedure, a full pre-anaesthetic evaluation that comprised a thorough review of routine investigations, a general and systemic examination, and a detailed history was carried out. Heart rate, blood pressure, and respiration rates were collected as baseline variables. Laboratory tests, such as routine blood and urine analyses, were performed. Vital signs such heart rate, blood pressure, respiration rate, and SpO₂ were monitored prior to induction. An intravenous access was established and all patients received Inj. Glyco pyrrolate 0.2mg if BW<100 kgs and 0.4mg, if BW >100 kgs and Inj. Fentanyl 30-40 µg intravenously. Patients were then assigned to one of two groups at random. After three minutes of preoxygenation with 100% O₂, anaesthesia was induced via an injection. Propofol 1% 10-15ml IV for patients over 100 kg or until spontaneous breathing stops. Lesser doses were used in patients with lesser BMI. Neuromuscular blocker succinyl choline, 1 mg/kg BW if BW 100 kg and 175 mg if BW > 100 kg, was administered intravenously to help with endotracheal intubation using an appropriate-sized, cuffed endotracheal tube. Anaesthesia was maintained with oxygen along with Desflurane or Sevoflurane on controlled mechanical ventilation. Volatile anaesthetic concentration was titrated to maintain electroencephalographic Bi-spectral Index (BIS) in the range of 40-60.

During the process, vital signs like the heart rate (HR), blood pressure, ECG, temperature, end-tidal CO₂, and oxygen saturation, were recorded. After surgery, injections were used to break the neuromuscular blockade. Glycopyrrolate 0.01 mg/kg and neostigmine 0.05 mg/kg intravenously once they were conscious and appropriate spontaneous breathing had been established. The patients were then transferred to the recovery room or post-anaesthesia care area (PACU). The inhalational agent's closure was determined to have occurred at time 0 hours. Recovery profile of the patients were studied by comparing following parameters: Spontaneous eye opening, response to painful stimuli, obeying of verbal commands. Baseline measurements of the patient's heart rate (HR), blood pressure (SBP), respiratory rate (RR),

and oxygen saturation (SpO₂) were made in the recovery room. Adverse effects associated with Desflurane or Sevoflurane, such as nausea and vomiting and respiratory complications, if any were recorded.

Statistical analysis

The SPSS package for Windows (version 17, SPSS Inc., Chicago, IL, USA) software was used for all statistical analysis. With a power of 80% and a sample size of 40 patients, a statistically significant result was calculated. Data is presented as mean, standard deviation, or median and range, as necessary. The statistical significance of the desflurane and sevoflurane groups for recovery characteristics was examined using the Student's t-test.

3. Results

In desflurane group, majority of the patients belonged to 41-60 years (66.7%) followed by 21-40 years (23.3%). In sevoflurane group, majority of the patients belonged to 41-60 years (53.3%) followed by 21-40 years (36.7%). There were 15 (50%) males and 15 (50%) females in the desflurane group, while 19 (63.3%) females and 11 (36.7%) males were present in the sevoflurane

group. Males and females were distributed equally in the desflurane group while females predominated in the sevoflurane group. In desflurane group, 3 (10%) were in Obese Class II and 27 (90%) were in Obese Class III. In sevoflurane group, 7 (23.3%) were in Obese Class II and 23 (76.7%) were in Obese Class III. All of the patients in the desflurane group and sevoflurane group were morbidly obese (100%). Among 1st group which is desflurane group, 90% of the patients had OSA (obstructive sleep apnoea), 76.7% had OA (osteoarthritis), 56.7% had HTN and 23.3% had DM. Among the 2nd group which is sevoflurane group, 86.7% of the patients had OSA (obstructive sleep apnoea), 80% had OA (osteoarthritis), 46.7% had HTN and only 3.3% of the patients had DM. In Desflurane group, 15 (50%) patients had undergone mini gastric bypass, 12 (40%) had undergone gastric bypass and 3 (10%) had undergone sleeve gastrectomy. In Sevoflurane group, 13 (43.3%) patients had undergone mini gastric bypass, 11 (36.7%) had undergone sleeve gastrectomy and 6 (20%) had gastric bypass. Most common surgical management was mini gastric bypass. In both the groups 4 (13.3%) each coughing was found, while rest of the patients in both the groups had no complications. (Table 1)

Table 1: Patient's characteristics

| Patient Characteristics | Desflurane (Group D) N (%) | Sevoflurane (Group S) N (%) |
|--------------------------|-------------------------------|--------------------------------|
| Age group | | |
| 19-20 years | 1 (3.3%) | 1 (3.3%) |
| 21-40 years | 7 (23.3%) | 11 (36.7%) |
| 41-60 years | 20 (66.7%) | 16 (53.3%) |
| 61-80 years | 2 (6.7%) | 2 (6.7%) |
| Gender | | |
| Female | 15 (50%) | 19 (63.3%) |
| Male | 15 (50%) | 11 (36.7%) |
| BMI | | |
| Obese class I | 0 | 0 |
| Obese Class II | 3 (10%) | 7 (23.3%) |
| Obese Class III | 27 (90%) | 23 (76.7%) |
| Co-morbidities | | |
| Morbid Obesity | 30 (100%) | 30 (100%) |
| OSA | 27 (90%) | 26 (86.7%) |
| OA | 23 (76.7%) | 24 (80%) |
| Hypertension | 17 (56.7%) | 14 (46.7%) |
| Type-2 diabetes mellitus | 7 (23.3%) | 1 (3.3%) |
| PCOD | 1 (3.3%) | 0 |
| DOE Grade 3 | 0 | 1 (3.3%) |
| Type of surgery | | |
| Gastric bypass | 12 (40%) | 6 (20%) |
| Mini Gastric Bypass | 15 (50%) | 13 (43.3%) |
| Sleeve gastrectomy | 3 (10%) | 11 (36.7%) |
| Complications | | |

| | | |
|----------|------------|------------|
| None | 26 (86.7%) | 26 (86.7%) |
| Coughing | 4 (13.3%) | 4 (13.3%) |

The mean reaction to painful stimuli in Desflurane group was found to be 3.76 ± 1.31 min, while in Sevoflurane group it was found to be 6.47 ± 1.37 min. The difference was determined to be statistically significant ($P = 0.05$), with the Sevoflurane group showing a greater mean response to painful stimuli than the Desflurane group. The mean time to obeying verbal commands in Desflurane group was found to be 5.19 ± 1.39 min, while in Sevoflurane group it was found to be 8.30 ± 1.39 min. The difference was found to be

statistically significant ($P = 0.05$), with the Sevoflurane group taking longer to obey verbal commands than the Desflurane group. The mean time to spontaneous eye opening in Desflurane group was found to be 4.52 ± 1.44 min, while in Sevoflurane group it was found to be 7.46 ± 1.55 min. The difference was determined to be statistically significant ($P = 0.05$), with the Sevoflurane group having a longer mean time to spontaneous eye opening than the Desflurane group. (Table 2)

Table 2: Comparison of recovery characteristics between desflurane and sevoflurane groups

| Parameter | Desflurane (Group D) (Mean \pm SD) | Sevoflurane (Group S) (Mean \pm SD) | 't' value | P value |
|-------------------------------|---|--|-----------|---------|
| Reaction to painful stimuli | 3.76 ± 1.31 | 6.47 ± 1.37 | 7.824 | 0.000 |
| Obeying verbal commands (min) | 5.19 ± 1.39 | 8.30 ± 1.39 | -8.715 | 0.000 |
| Spontaneous eye opening (min) | 4.52 ± 1.44 | 7.46 ± 1.55 | 7.595 | 0.000 |

4. Discussion

Laparoscopic treatments for bariatric surgery are preferred over open ones because they result in less morbidity and allow for a much faster return to normal activities due to less postoperative discomfort. Less narcotic medication is required both intraoperatively and postoperatively, improving oxygenation and lowering the risk of postoperative nausea and vomiting, particularly in the first few days after surgery. Early and complete recovery after general anaesthesia is critical in all patients, but especially in morbidly obese individuals. Over time, adipose tissue develops an accumulation of all volatile anaesthetics. Such accumulation might impede post-anaesthesia recovery. In morbidly obese persons, the effects of anaesthetic stored in fat may be amplified, especially after extended anaesthesia.⁷ Bhansal T et al⁸ a study revealed that there was no statistically significant difference between the two study groups in the amount of time needed to recover from volatile anaesthetic drugs for eye opening on verbal command, sustained head lift for 5 s, extubation, and orientation to time, place, and person. This is in contrast to our study which showed that recovery characteristics of desflurane are better than sevoflurane in morbidly obese patients. Mayur Patel et al⁹ showed that in patients receiving day care gynaecological laparoscopic surgery, the hemodynamic parameters and recovery features of Sevoflurane and Desflurane were compared. They discovered that patients who received Desflurane experienced responses to painful stimuli, eye

opening, vocal orders, and spontaneous eye opening substantially faster than patients who received Sevoflurane. Regarding the frequency of problems, there was no difference between the two groups, and the aforementioned findings are consistent with the findings of our study. Similar research was done by Harpreet et al.¹⁰ to compare the recovery characteristics of patients following laparoscopic cholecystectomy under isoflurane, sevoflurane, and desflurane anaesthesia. Based on spontaneous breathing and eye opening, the time to extubate was determined to be $11.63 + 4.348$ mins for isoflurane, $9.55 + 6.528$ mins for sevoflurane, and $8.23 + 1.888$ mins for desflurane. The following study highlights the fact that desflurane has better recovery characteristics than sevoflurane and isoflurane which supports our study. The complications of pain and nausea and vomiting were seen, but they were statistically not significant further supporting results of our study. Kaur A et al² conducted a study showing that morbidly obese patients undergoing laparoscopic bariatric surgery, desflurane and sevoflurane were compared for their effects on intraoperative hemodynamics and postoperative recovery traits. Both desflurane and sevoflurane cause comparable hemodynamic alterations, but desflurane's immediate and intermediate recovery was noticeably quicker, contributing to quick tracking and early patient discharge, which was consistent with the results of our study. Bhensdadia A et al¹¹ conducted a study in which patients undergoing laparoscopic surgery, they have compared and evaluated the intraoperative hemodynamic and recovery

characteristics after anaesthesia with sevoflurane and desflurane. In comparison to group S, the time to recovery for criteria such as responsiveness to painful stimuli, verbal command response, spontaneous eye opening, declaring name and location of stay, squeezing fingers, and limb raising is much shorter in group D. Patients in group D responded to vocal commands on average in 4.9 minutes as opposed to 7.46 minutes in the group receiving sevoflurane which was similar to the findings our study. Shah JR et al¹² findings from a different study comparing the effects of sevoflurane and desflurane anaesthesia on emergence and extubation during laparoscopic procedures also demonstrated that group D patients take longer to respond to painful stimuli, comply with verbal commands, and open their eyes on their own., state their name and where they are staying, squeeze their fingers, and lift their limbs is significantly shorter than that of group S patients. which was similar to our study findings.

5. Conclusion

On comparing recovery properties of sevoflurane and desflurane in morbidly obese patients during laparoscopic bariatric surgeries or metabolic surgeries under general anaesthesia, we concluded that desflurane has better emergence characteristics as compared to Sevoflurane.

6. References

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