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COMPARISON OF SEVOFLURANE AND ISOFLURANE FOR RECOVERY FROM ANAESTHESIA IN LAPAROSCOPIC SURGERY

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Abstract

Background: Recovery from anaesthesia is very important aspect in terms of morbidity, hospital stay and cost effectiveness. Since last two to three decades anaesthesia has evolved with different intravenous and inhalational anaesthetic agent. Inhalational anaesthetic agent found to be better for rapid recovery as they are easily washed out through lungs with minimal metabolism in body. Isoflurane and sevoflurane are routinely used inhalational anaesthetic agent which have different recovery time. Short recovery time is useful in day care surgeries as well as less hospital stay and less postoperative complications. That is why this research, titled "Comparison of sevoflurane and isoflurane for recovery from anaesthesia in laparoscopic surgery" was done

Methods: After institutional ethical committee clearance and informed consent from the patients, 80 patients of either sex, aged 18-65 years, belonging to ASA I and II were enrolled in the study. The patients were allocated into two groups of 40 patients each. Group -S: received sevoflurane 1.8% Group –I received isoflurane 1.15%

Results: 02(5%) patients in Isoflurane group and 18(45%) patients in sevoflurane group had recovery time 4-8 min. The mean recovery time of patients who were given sevoflurane (group S=8.58+-1.56) is less compared to patients who were given isoflurane (group I=12.18+-2.14). This difference was statistically significant.

Conclusions: Our study found rapid recovery with sevoflurane as compared to isoflurane from anaesthesia in patients who underwent laparoscopic surgeries.

Keywords: Isoflurane, Sevoflurane, Recovery from anaesthesia

INTRODUCTION

General anaesthesia is defined as "A drug induced, reversible condition that includes unconsciousness, amnesia, analgesia and immobility with maintenance of physiological stability". Inhalational agents are halogenated hydrocarbon. Inhalational anaesthetic agents like nitrous oxide, halothane, isoflurane, desflurane, sevoflurane which are most commonly used for induction and maintenance of general anaesthesia in the operating room. [1]

The volatile anaesthetics are liquids at room temperature and require the use of vaporizers for inhalational administration.[2] All inhalational anaesthetics provide amnesia and immobility, except for nitrous oxide, which provides analgesia. Inhaled anaesthetics are commonly used in combination with IV anaesthetic agents. These agents have FDA approval for use as a general anaesthetic and sedation agent in the operating room.[1]

Laparoscopic surgeries have gained widespread acceptance due to their minimally invasive nature shorter hospital stays and faster postoperative recovery. Ambulatory anesthesia allows quick recovery from anesthesia, leading to an early discharge, less post operative complications and rapid resumption of daily activities.[3]

An ideal day-care anaesthetic agent should have rapid smooth induction, provide optimum surgical conditions with rapid recovery and minimal side effects.[2] Among the commonly used volatile anaesthetics, isoflurane and sevoflurane are widely employed due to their favorable anaesthetic properties, hemodynamic stability and ease of titration.

While no single anaesthetic agent fulfils all necessary criteria, advancements in pharmacology over the past few decades have made significant progress towards that goal. Given the increasing emphasis on enhanced recovery after surgery (ERAS) protocols, selecting an anaesthetic agent that facilitates early emergence and minimal postoperative side effects

is critical. Understanding the differences in the recovery profiles of isoflurane and sevoflurane is essential for optimizing anaesthetic management, improving patient outcomes and ensuring efficient utilization of healthcare resources. [2]
With this interest in mind, a study was conducted to compare isoflurane and sevoflurane in terms of recovery time from anaesthesia, intraoperative hemodynamics and adverse effects.

METHODS
Total 80 patients of ASA physical status I and II were included in the study after obtaining institutional ethical committee approval and written informed consent of patients. Patients of age between 18 to 65 years, posted for elective laparoscopic surgery under general anaesthesia, were randomly allocated to one of the two study groups (n=40)

Group I – Patients who received Isoflurane as inhalational anaesthetic during surgery

Group S – Patients who received Sevoflurane as inhalational anaesthetic during surgery

The patients with known hepatic, renal dysfunction, chronic lung disease, coagulation disorder, hypertension, diabetes mellitus and obesity with BMI >30 were excluded from study. Investigations like blood grouping, complete blood count, liver, kidney function tests, ECG and XRAY chest were done.
On the day of surgery, a peripheral intravenous access was secured. A written informed consent was taken prior to surgery. Baseline parameters – ECG, NIBP and pulse oximetry were noted in the pre operative room. Patients were shifted to the operation theatre and all ASA standard monitors were attached. Patients were premedicated with injection glycopyrrolate 0.004mg/kg, injection midazolam 0.03 mg/kg and injection fentanyl 2 mcg/kg. Preoxygenation was started with 100% oxygen for 5 minutes.
Induction of anaesthesia was done with 2mg/kg of Injection Propofol intravenously and tracheal intubation was facilitated by 2mg/kg of intravenous succinylcholine. After endotracheal intubation, anaesthesia was maintained with oxygen, isoflurane in group I and sevoflurane in group S under controlled mechanical ventilation. The time of initiation of inhalational agent was noted. All surgeries were performed using similar type of circle breathing system and vaporizer of Sevoflurane or Isoflurane by same manufacturer under standard operating room conditions. Muscle relaxation was maintained with initial loading bolus dose of intravenous vecuronium 0.1 mg/kg followed by bolus of 0.01mg/kg as maintenance dose at intervals or as clinically judged.
A tidal volume of 8 ml/kg with respiratory rate of 14 breaths per minute, I:E ratio of 1:2 was maintained during the surgery and not changed unless required. Inspiratory and expiratory concentrations of oxygen, nitrous oxide, carbon dioxide and inhalational agent along with MAC was recorded using a multigas monitor throughout the surgery. All hemodynamic parameters were also noted.
Towards the end of the surgery, the vaporiser dial of the inhalational agent was turned off. The time required for return of spontaneous respiration and consciousness was noted. Modified Aldrete's score was used to assess the recovery characteristics. Residual neuromuscular block was antagonized with 0.05 mg/kg of Inj. Neostigmine and 0.01 mg/kg of Inj. Glycopyrrolate, and patients were extubated after return of all reflexes. The score at extubation was also recorded.
Patient scoring >=8 (or are returned to preoperative status) are considered fit for transition to phase II recovery. Recovery time was defined as the time of discontinuation of the inhalational anesthetic agent to the time, the patient opened his/her eyes on verbal command or Modified Aldrete's scores >=8 while recovering from anesthesia.

Table 1 – Modified Aldrete's score

Criteria	Characteristics	Points
Activity	Able to move 4 extremities	2
	Able to move 2 extremities	1
	Unable to move extremities	0
Respiration	Able to breathe deeply and cough freely	2
	Dyspnea or limited breathing	1
	Apneic	0

Circulation	BP +/- 20% of pre-anesthetic level	2
	BP +/- 20-49% of pre-anesthetic level	1
	BP +/- 50% of pre-anesthetic level	0
Consciousness	Fully awake	2
	Arousable on calling	1
	Not responding	0
Oxygen saturation	Able to maintain SpO_2 >92% on room air	2
	Needs oxygen to maintain SpO_2 >90%	1
	SpO_2 <90% even with supplemental oxygen	0

RESULTS

The patients in both the groups were comparable with respect to age. Male and female patients were equally distributed between both the groups. The type of surgery, ASA grades and the duration of surgery was comparable between the two groups.

Table 2 – Comparison between age, duration of surgery between the two groups

Parameter	Group I (Mean±SD)	Group S (Mean±SD)	p value
Age	39.23±13.18	34.98±12.51	0.14
Duration of surgery	143.25±15.25	136.25±20.59	0.88

Table 3 – Comparison of gender between the two study groups

Gender	Group I %	Group S %	p value
Male	14(35.0)	20(50.0)	0.17
Female	26(65.0)	20(50.0)	
Total	40	40	

Table 4 – Association between ASA grading and the inhalational agent used

ASA grading	Type of inhalational agent		p value
	Group I %	Group S %	
Grade I	22(55.0)	27(67.5)	0.11
Grade II	18(45.0)	13(32.5)	
Total	40(100.0)	40(100.0)	

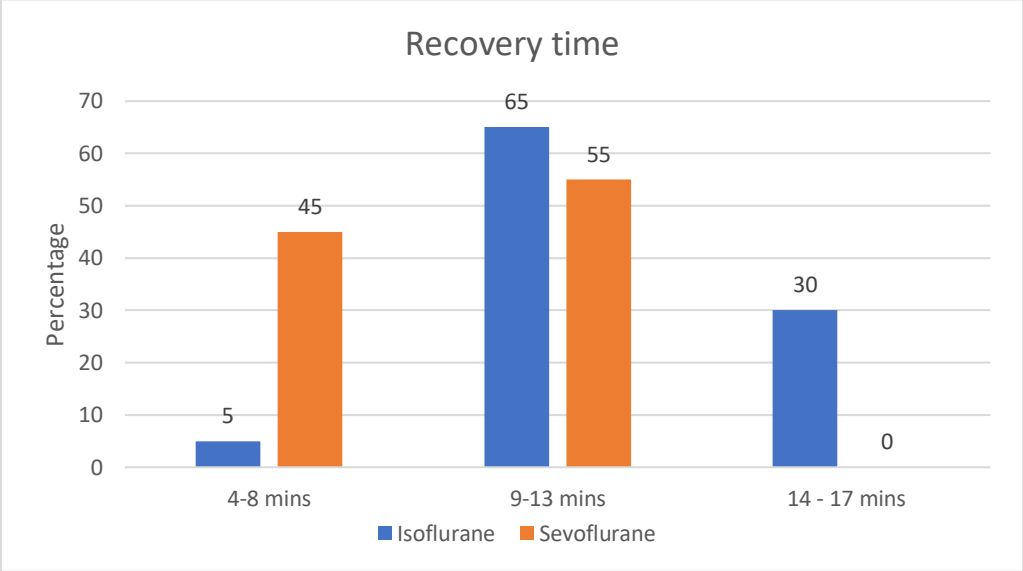
The recovery time from anaesthesia, that is the time from stopping of inhalational anaesthetic to the time patient's Aldrete score reached >=8 was studied. Maximum 26(65%) patients in group I and 22(55%) patients in group S had a recovery time of 9-13 min. About 02(5%) patients in group I and18(45%) patients in group S had short recovery time of 4-8 min. And also, 12(30%) patients in group I had recovery time 14- 17 min while none in group S.

The mean recovery time was less in the sevoflurane group when compared to the isoflurane group and was found to be statistically significant

Table 5 – Comparison of mean recovery time between two study groups

Recovery time	Group I	Group S	p value
Mean ± SD (min)	12.18±2.147	8.58±1.567	**0.01**

Figure 1 – Pictorial representation of recovery time between the two study groups



Hemodynamic parameters like heart rate, systolic, diastolic, mean arterial pressure and oxygen saturation were studied at various time intervals – Preoperatively, after pre medication, after induction, after intubation, after inhalational agent administration and after extubation. All hemodynamic parameters when compared between two groups remained statistically insignificant during the perioperative period.

Table 6 – Comparison of heart rate, systolic, diastolic blood pressure and oxygen saturation between the two study groups

Parameter	Group I (mean ± SD)	Group S (mean ± SD)	p value
Heart rate	86.4±12.6	86.18±12.8	0.938
SBP	117.4±13.02	116.9±13.2	0.865
DBP	72.9±12.6	72.07±12.9	0.77
MAP	77.38±3.43	76.68±3.25	0.35
SpO2	98.6±0.6	99.7±0.4	0.54

DISCUSSION

There is a great deal of pressure to improve general anaesthesia techniques in this era of heighten concern over rising costs and the negative environmental impact of chlorofluorocarbons. Inhalational anaesthetics are widely used due to their predictable pharmacokinetics, ease of administration and ability to maintain hemodynamic stability. They remain as a cornerstone of modern anaesthesia.[1]

The ideal anesthetic for ambulatory surgery would provide for a rapid, smooth, and pleasant induction of anesthesia, facilitate maintenance of an adequate depth of anesthesia by permitting rapid changes in the effect site concentration, and result in a prompt emergence and rapid recovery without postoperative side effects. [2]Agents such as sevoflurane which is non irritating for airway allow for well tolerated induction.

Patients in both the groups were comparable demographically. Speed and quality are important elements of anaesthetic recovery. Recovery from anaesthesia was assessed using Aldrete's score. The time to achieve Aldrete score >=8 at the earliest of 4-8 minutes were 2 patients in group I and 18 patients in group S. 26 patients in group I and 22 patients in group S had a recovery time of 9-13 minutes. At 14-17 minutes about 12 patients in the group I recovered from anaesthesia while it was zero in the group S. The mean recovery time of patients in the group S was statistically significant when compared to the group I.

A study conducted by Smith I et al[7] compared recovery from sevoflurane anaesthesia with propofol and isoflurane anaesthesia. They found out that isoflurane permitted emergence within 6.7 minutes as compared to 4.1 minutes with sevoflurane which was statistically significant and the findings correlated with our study. Another study conducted by Sahu et al[2] that studied sevoflurane and isoflurane anaesthesia on day care surgeries with LMA concluded that the mean recovery time in isoflurane group was 6.7±2.2 minutes and in sevoflurane group was 4.1±2.2 minutes. This was found to be statistically significant.

In a study conducted by Maheshwari et al[6], patients who received isoflurane had a slightly longer emergence time of 16 minutes when compared to sevoflurane which was 14 minutes. Although this difference did not prolong the stay in post anaesthesia care unit according to their study.

One of the primary determinants of anaesthetic recovery is the blood/gas partition coefficient, which reflects the solubility of an agent in blood. Sevoflurane, with a lower blood/gas partition coefficient of 0.65, has a faster alveolar washout leading to quicker elimination and shorter recovery time compared to isoflurane 1.46, which is more soluble in blood and thus eliminated more slowly. The lower blood/gas solubility enables the anaesthetic alveolar concentration to remain close to the inspired concentration, further allowing for a rapid and large change in anaesthetic depth with precise control, as well as an early awakening. In contrast, isoflurane due to its slightly higher solubility leads to slower clearance from blood when compared to sevoflurane.

While the longer recovery time may not be a significant concern in inpatient surgeries, it can be a limitation in outpatient surgical procedures where rapid discharges are desired. Also, sevoflurane has been associated with faster neurocognitive recovery, allowing patients to regain orientation and motor functions more quickly when compared to isoflurane.

Limitation of our study was that population covered only elective laparoscopic surgeries under general anaesthesia so results cannot be generalized to patients of all type surgeries. Further studies need to be conducted on large study population size including patients posted for all type surgeries.

CONCLUSION

In our study, we conclude that there was a faster recovery time from anaesthesia in patients who received sevoflurane when compared to patients who received isoflurane who underwent laparoscopic surgeries. While both isoflurane and sevoflurane are effective volatile anaesthetics, sevoflurane offers faster emergence and quicker cognitive recovery and is suitable for patients undergoing elective laparoscopic surgeries under general anaesthesia.

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