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Original Research Article

A Comparative Study of Desflurane and Sevoflurane for Hemodynamic Ability and Postoperative Outcome under General Anesthesia

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Abstract:

General anaesthesia can be defined as reversible depression of central nervous system resulting in loss of consciousness and absence of response to external stimuli. General anaesthesia is usually defined as triad of amnesia, analgesia and muscle relaxation. Inhalational anaesthetics are the drugs which are most commonly used for the maintenance of general anaesthesia. Adding only a small amount ofvolatile anaesthetic to the inspired mixture of gases results in a state of unconsciousness and amnesia.

Materials and Methods: This study done at Dept of Anaesthesiology, ESIC Medical College and Hospital Kalaburagi, the study was conducted in 40 patients. All were ASA I and II patients undergoing elective surgical procedures under general anesthesia lasting for less than 2 hours but more than 1 hour duration. After getting consent, the anesthetic technique was performed.

Results: Majority of the study participants belonged to the age group 31-40 years inboth the groups and in total. The age did not differ significantly in both groups hence both the groups are comparable in terms of age.

Conclusion: The aim of this study is to prospectively compare the hemodynamic, emergence and recovery characteristics of sevoflurane with that of desflurane in general anesthesia.

Keywords: Sevoflurane, Desflurane, General anesthesia.

Introduction

The introduction of general anaesthesia in the field of medicine remains as one of the important milestone. The introduction of general anaesthesia contributes to development in the field of surgery and expanded the boundaries of anaesthesia. General anaesthesia can be defined as reversible depression of central nervous system resulting in loss of consciousness and absence of response to external stimuli. General anaesthesia is usually defined as triad of amnesia, analgesia and muscle relaxation. Inhalational anaesthetics are the drugs which are most commonly used for the maintenance of general anaesthesia. Adding only a small amount ofvolatile anaesthetic to the inspired mixture of gases results in a state of unconsciousness and amnesia. When combined with intravenous adjuvants, opioids, benzodiazepines and muscle relaxants, a balanced anaesthetic technique is achieved that results in analgesia, amnesia andmuscle relaxation. The popularity of the inhaled anaesthetics is because of their ease of administration and the ability to reliably monitor their effects with clinical signs and end tidal concentration. Inhalational volatile anaesthetics remain the most widely used drugs for maintenance of general anesthesia because of their predictable intraoperative and recovery characteristics. Management of intraoperative haemodynamic stability and early recovery is the most important part of a standardized balanced technique. Rapid induction and recovery may lead to faster operating room turnover times, shorter recovery room stays, and earlier discharges to home. Over the last 15 years, there has been an explosive growth in the trend to provide cost-effective care in the practice of medicine. Ambulatory surgery is an increasingly important part of that trend. Ambulatory surgery continues to grow and thrive such that the vast majority (65–70%) of all surgical procedures is performed on an outpatientbasis. Expeditious recovery and shorter hospital stays are necessary to improve efficiency of an ambulatory facility and reduce health care costs. One of the major factors that determine the speed of recovery from anesthesia is the choice of anesthetic technique. Although local and regional anesthesia techniques are increasingly used in the ambulatory setting because they allow a more rapid recovery, general anesthesia is stillthe most common anesthetic technique. An ideal general anesthetic technique should provide smooth and rapid induction, optimal operating conditions, and rapid recovery with minimal or no side effects. It is also beneficial if the anesthetic technique allows for fast tracking (i.e,

transferring patients directly from the operating room to the phase II unit, thus bypassing the postanesthesia care unit [PACU]). Rapid emergence from anaesthesia is possible with inhalational anaesthetics which makes them suitable for ambulatory surgery. The availability of less soluble inhalation anaesthetics such as sevoflurane and desflurane made us rethink about the selection of volatile anaesthetics for outpatient surgical procedures. Given the low blood: gas partition coefficient of sevoflurane and desflurane, faster emergence from anaesthesia is expected compared totraditional inhalation anaesthetics. The purpose of this study was to compare the hemodynamic and recovery characteristics of desflurane and sevoflurane in general anaesthesia. Nathanson MH, Fredman B, Smith I, White PF compared the recovery characteristics of desflurane and sevoflurane when used for maintenance of ambulatory anesthesia. They found that sevoflurane was associated with a slower emergence from anesthesia than desflurane .However Recovery of cognitive function and discharge times were similar between desfluraneand sevoflurane. They concluded that sevoflurane is an acceptable alternative to desflurane for maintenance of outpatient anesthesia.[1] Edmond I. Eger et al studied the recovery and Kinetic Characteristics of Desflurane and Sevoflurane in Volunteers. They found that Short- and long-term awakening is approximately twice as fast with desflurane than with sevoflurane. Slower awakening after anesthesia with sevoflurane may result from slower elimination in end-tidal gas and greater tissue solubility.They concluded that the slower awakening also may result from the effectsof degradation products of sevoflurane.[2] Gergin S et al compared the Haemodynamic Parameters and Recovery Characteristics of Sevoflurane Vs Desflurane. They concluded that desflurane, like sevoflurane, maintains haemodynamic stability during intraoperative period. Although the duration of anaesthesia was longer, early recovery profile was rapid in desflurane group. The difference between late recoveries was comparable between groups.[3] Ebert TJ, Muzi M studied the effect of desflurane anaesthesia on Sympathetic activity in healthy volunteers. Titration of desflurane following thiopental induction and increasing the concentration of desflurane from 1.0 to 1.5 MAC result in sympatho-excitation, hypertension and tachycardia in healthy, young volunteers. [4] Weiskopf RB studied the effect of rapid increase in desflurane concentration compared with isoflurane in healthy male volunteers. Rapid increases of desflurane or isoflurane from 0.55 to 1.66 MAC increasesympathetic and renin-angiotensin system activity, and cause transient increases in arterial blood pressure and heart rate. Desflurane causes significantly greater increases than isoflurane, and also causes a transient increase in plasma AVP concentration. The temporal relationships suggest that the increased sympathetic activity increases mean arterial blood pressure and heart rate, with mean arterial blood pressure also increased byincreased plasma AVP concentration, whereas the delayed, increased plasma renin activity is likely a response to the ensuing hypotension, or earlier inhibition by AVP, or both. [5] Eger II EI, Gong D, Koblin DD, et al studied the effect of anesthetic duration on kinetic and recovery characteristics of desflurane vs. sevoflurane in volunteers. They concluded that regardless of the duration of anesthesia, elimination is faster and recovery is quicker for the inhaled anaesthetic desflurane than for the inhaled anesthetic sevoflurane. [6] McKay RE, Large MJC, Balea MC, McKay WR Compared the return of airway reflexes after desflurane anesthesia with sevoflurane anesthesia. Theyconclude that desflurane allows an earlier return of protective airway reflexes than sevoflurane. The time from stopping anesthetic administration to appropriate response to command was also longer after sevoflurane compared to desflurane [7]

Materials and Methods

This study done at Dept of Anaesthesiology, ESIC Medical College and Hospital Kalaburagi, the study was conducted in 40 patients. All were ASA I and II patients undergoing elective surgical procedures under general anesthesia lasting for less than 2 hours but more than 1 hour duration. After getting consent, the anesthetic technique was performed.

Selection of Patients:

The patients selected for this study were of ASA Risk I&II undergoing elective surgical procedures under general anesthesia lasting for less than 2hours but more than 1 hour duration. It was a prospective randomized controlled single blinded study. The patients exhibiting the following were excluded from the study.

Significant cardiovascular, respiratory, hepatic, renal, neurologic diseases. Psychiatric or metabolic disease.

Recent anesthetic exposure within previous seven days.History of allergic reaction to drugs.

Potential susceptibility to malignant hyperthermia. Patient on chronic opioid analgesic or sedative treatment.

Age group: Age of the patients ranged from 18 to 60 years.

Result

Table 1: Age distribution profile in both the groups:

Variables	Sevofluran group N = 20	Desfluran group N = 20	Total N = 40	P value
Age (in years)				
20 – 30	3 (15%)	4 (20%)	7 (17.5%)	
31- 40	8 (40%)	6 (30%)	14 (35%)	
41 – 50	5 (25%)	7 (35%)	12 (30%)	0.872
>50	4 (20%)	3 (15%)	7 (17.5%)	
(Mean ± SD)	40.1±9.3	40.6±10.1	40.4±9.6	
Range	24 – 56	23 – 59	23 – 59	

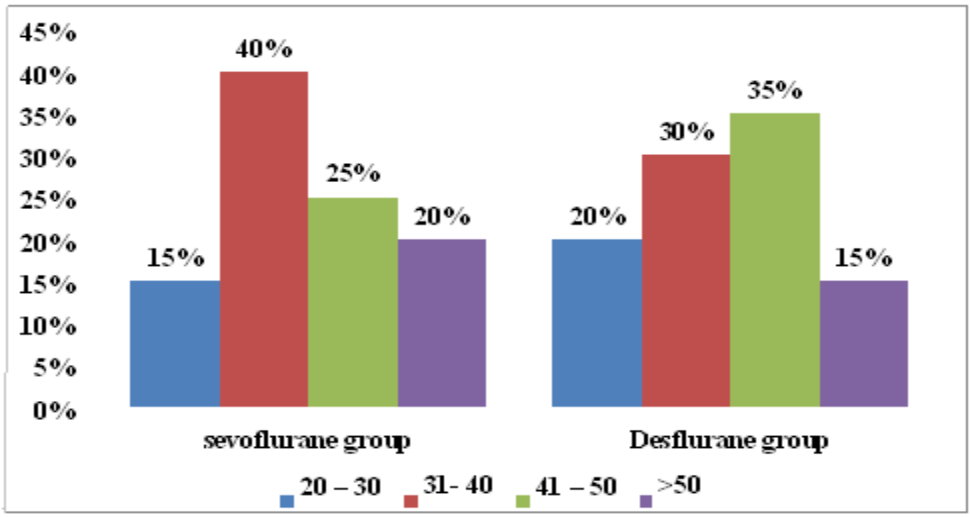

Chart 1: Age distribution profile in both the groups:

Majority of the study participants belonged to the age group 31-40 years inboth the groups and in total. The age did not differ significantly in both groups hence both the groups are comparable in terms of age.

Table 2: Sex distribution profile in both the groups:

Variables	Sevofluranegroup N = 20	Desfluranegroup N = 20	Total N = 40	P value
Sex				
Male	11 (55%)	10 (50%)	21 (52.5%)	0.752
Female	9 (45%)	10 (50%)	19 (47.5%)	

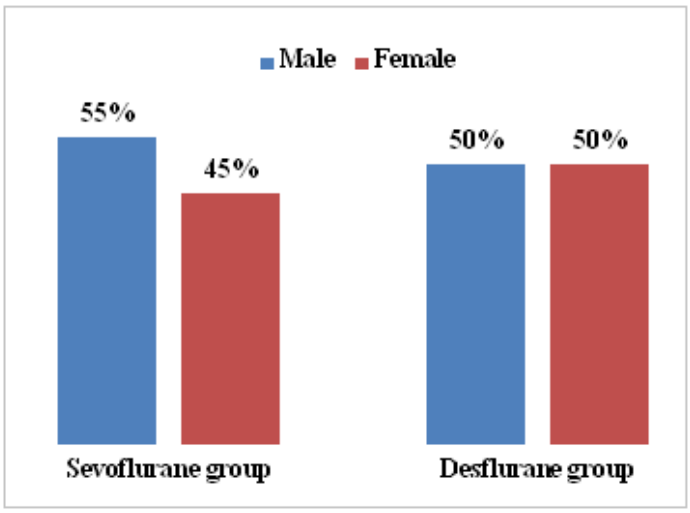

Chart 2: Sex distribution profile in both the groups:

There was equal distribution among male and female in both the groups. There was no significant difference in sex distribution of both groups (P>0.05).

Table 3: ASA distribution profile in both the groups:

Variables	Sevoflurane group N = 20	Desfluran group N = 20	Total N = 40	P value
ASA				
I	11 (55%)	10 (50%)	21 (52.5%)	0.752
II	9 (45%)	10 (50%)	19 (47.5%)	

There was equal distribution of both ASA grading's in both the groups.There was no significant difference in ASA grade of both groups (P>0.05)

Table 4: Weight distribution profile in both the groups:

Variables	Sevofluranegroup N = 20	Desfluranegroup N = 20	Total N = 40	P value
Weight				
Mean±SD	57.6±5.9	61.2±5.6	59.4±6	0.06
Range	48 - 71	50 – 70	48 - 71	
(Minimum-				
Maximum)				

There was no significant difference in the mean weight of the study participants in both the groups. Both the groups were comparable in terms of weight. The mean weight in group II was slightly higher 61kgs.

Table 5: Comparison of Mean arterial pressure during the course ofanaesthesia in both groups:

Duration	Sevofluranegroup Mean±SD	Desfluranegroup Mean±SD	T statistic	P value
Pre – op	84±4.6	83.6±4.4	0.278	0.783
Induction	74.7±5.4	77.2±4.0	-1.64	0.108
15 mins	80.6±7.7	80.4±6.6	0.066	0.948
30 mins	78.9±4.8	78.7±4.3	0.173	0.864
45 mins	76.5±5.2	76±4.2	0.333	0.741
60 mins	75.6±5.6	74.3±4.5	0.803	0.427
75 mins	73.4±5.1	73.1±4.9	0.157	0.876
90 mins	75.7±8.2	73.2±5.9	1.08	0.287
105 mins	75.7±7.3	75.7±6.5	-0.020	0.984
120 mins	81.6±4.3	81.8±5.6	-0.041	0.968

Table 6: Comparison of Pulse rate during the course of anaesthesia in bothgroups:

Duration	Sevofluranegroup Mean±SD	Desfluranegroup Mean±SD	T statistic	P value
Pre – op	84.6±7.3	84.7±8.1	-0.061	0.951
Induction	78.4±7.2	77±7.6	0.597	0.554
15 mins	83.7±6.3	82.4±6.3	0.646	0.522
30 mins	82.6±6.0	81.4±6.1	0.623	0.537
45 mins	80.2±6.0	78.8±5.8	0.745	0.461
60 mins	78.2±5.8	77±4.7	0.709	0.482
75 mins	77.1±6.0	77±6.5	0.050	0.960
90 mins	79.2±7.4	76±6.6	0.160	0.162
105 mins	84.3±11.1	82.2±11.5	0.794	0.610
120 mins	97±4.6	90.6±9.2	0.069	0.148

The Pulse rate in both groups did not vary significantly (P>0.05) in both groups during the course of anaesthesia. Thus the haemodynamicparameters in both groups did not differ from each other.

Discussion

General anesthesia is popular among the surgeons, anaesthesiologists, and patients and still remains the mainstay of anesthesia in many centres acrossthe world. With the introduction of less soluble volatile anaesthetics like desflurane and sevoflurane which promotes early recovery and also maintains hemodynamics stability and provide amnesia makes general anesthesia the technique of choice for many patients. It is desirable to have a faster recovery from anesthesia. This study compared the hemodynamic, emergence and recovery characteristics of sevoflurane with desflurane in general anesthesia. The time to spontaneous eye opening, response to painful stimuli were shorter in the desflurane group. The time to response for verbal commands,telling name, and squeezing fingers were also shorter in the desflurane group compared to sevoflurane group. The time to response for painful stimuli is lesser in desflurane group which is 3.6 mins as compared to sevoflurane group which is 5.6 mins. The time to

response for verbal commands is lesser in desflurane group which is 4.3 mins as compared to sevoflurane group which is 6.2 mins. The time to eye opening is lesser in desflurane group which is 5 mins as compared to sevoflurane group which is 6.85 mins The time to telling name is lesser in desflurane group which is 5.7 mins as compared to sevoflurane group which is 7.5 mins. The time to squeezing fingers is lesser in desflurane group which is 6.4 mins as compared to sevoflurane group which is 8.3 mins Aldrete score at 5 minutes was higher with desflurane group (mean=8.2) than with sevoflurane group (mean=6.9). 10 minutes Aldrete score was also higher with desflurane group (mean=9.3) compared to sevoflurane group (mean=8.1). The study by Nathanson et al. [1] suggested that sevoflurane and desflurane provided similar intraoperative conditions during the maintenance period. Although early recovery was more rapid after desflurane, there was no difference in later recovery end-points. Song et al. [8] found that the late recovery profiles and incidences of postoperative side effects were similar after desflurane and sevoflurane. It was also showed that regardless of the duration of anaesthesia, elimination was faster and recovery was quicker for the inhaled anaesthetic desflurane than for the inhaled anaesthetic sevoflurane. In our study also, recovery was earlier with desflurane than with sevoflurane Hemodynamic profile: S Gergin, B Cevik et al. [2] in their study concluded that desflurane, like sevoflurane, maintains haemodynamic stability during intraoperative period. In our study also, both the desflurane and sevoflurane maintained the hemodynamics within 20% of the baseline values. Hypotension was easily managed with fluids and blood replacement and none of the patients were excluded in both the groups. There was no significant difference in total dose of fentanyl /vecuronium used between two groups.

Conclusion

The aim of this study is to prospectively compare the hemodynamic, emergence and recovery characteristics of sevoflurane with that of desflurane in general anesthesia. 40 ASA I and II patients undergoing elective surgical procedures less than 2 hours duration under endotracheal general anaesthesia were randomly divided into two groups. Both the groups were induced with standard intravenous induction technique.

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