

To Compare the Haemodynamic Characteristics of Sevoflurane and Desflurane Anaesthesia and Fast Track Criteria of Recovery after Ambulatory Surgery

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ABSTRACT

Background: The number and variety of procedures done on day care basis has rapidly increased in recent past. For day care anaesthesia, the use of anaesthetics that provide fast and smooth induction, allow quick changes in depth while maintaining anaesthesia, early recovery and less post-operative nausea and vomiting are recommended. The aim of this study to compared the haemodynamic characteristics of sevoflurane and desflurane anaesthesia and Fast track criteria of recovery after ambulatory surgery.

Materials & Methods: A double blind randomized study in the Department of Anaesthesiology and Intensive Care Unit at Govt. Medical College, Amritsar. 100 patients of American Society of Anaesthesiologist grade I or II in the age group of 20 to 50 years undergoing short surgical procedure under general anaesthesia were included. Continuous monitoring of vitals was started after attaching Multipara monitor. In first 15 minutes of intra-operative period monitoring of BP, HR, SPO₂ and ECG pattern were done every 5 minutes after that time interval was changed to 10 minutes till completion of surgery. After completion of surgery emergence time was noted. In recovery room assessment of variables required for fast track scoring system were recorded after every 5 minutes. All the results were be compiled, analyzed statistically and the appropriate test was applied and the blinding of the study was opened at the end.

Results: Our study showed that the mean age of patients in

both the groups was found to be statistically insignificant ($p>0.05$). The mean duration of surgery in both the groups was found to be statistically insignificant ($p>0.05$). The fast track score in group S and D at different time interval was statistically insignificant ($p>0.05$) and the maximum number of patients achieving PADDs score between 60-120 minutes. 83% patients were ready to go home at 120 minutes.

Conclusion: We concluded that both the inhalational anaesthetics i.e. sevoflurane and desflurane provide similar haemodynamic stability, but desflurane is associated with faster emergence as compared to sevoflurane.

Keywords: Sevoflurane, Desflurane, Haemodynamic Stability.


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INTRODUCTION

One of the most significant changes in surgical practice over the past decade is the change of emphasis from inpatient to day care surgery. Recent advancement in anaesthetic and surgical techniques have allowed this rapid growth in day care surgery throughout the world. Several experts predict that in the years to come, nearly 80% of all surgeries performed in the United States will be on an ambulatory basis.¹

The advances in surgery, anaesthesia and pain management have allowed great expansion of this modality of care with a consequent reduction in the need for hospitalization.

The various types of urgent surgery suitable for day case procedures are incision and drainage of abscess, fibroadenoma, hydrocele, inguinal hernia laparoscopic cholecystectomy, laparoscopic appendectomy, temporal artery biopsy, evacuation

of retained products of conception, laparoscopic ectopic pregnancy, tendon repair, manipulation of fractures, plating of fractured clavicle, manipulation of fractured nose, repair of fractured mandible/zygoma.²⁻⁶

Appropriate patient selection and preparation is crucial for day surgery so as to ensure early and rapid recovery. Recovery from anaesthesia is a continual process, the early stages of which overlap the end of intra-operative care. Patients cannot be considered fully recovered until they have returned to their preoperative physiological state. This entire process may last many days, but it can be conveniently divided into three distinct phases.⁷

- Phase I (early recovery) it normally takes place in the high-dependency atmosphere of the post-anaesthesia care unit (PACU) with suitably trained nursing staff.
- Phase II recovery is defined when patients have recovered enough to allow their safe transfer to an ambulatory surgical unit (ASU).
- Phase III recovery is a stage when full recovery of the patient occur i.e. psychological recovery to the preoperative state.

The various benefits of day care surgery are that there is reduced dependence on availability of hospital beds, which results in greater flexibility in scheduling operations and there is short surgical waiting lists. Day care surgery allows earlier return to pre-morbid physiological state which results in lower overall procedural costs and greater turnover of patients. It also leads to less incidence of hospital acquired infections and respiratory complications.

Outpatients receiving general anaesthesia are usually transferred from the operating room (OR) to the post-anaesthesia care unit (PACU) and then to the Phase II (step-down) unit when they have fulfilled the PACU discharge criteria. The availability of rapid and shorter-acting intravenous (IV) (e.g. propofol) and volatile (e.g., desflurane and sevoflurane) anaesthetics has facilitated early recovery in the ambulatory setting. Therefore, patients can be completely awake and oriented, breathing comfortably, with stable vital signs in the OR shortly after a brief ambulatory surgical procedure under general anaesthesia. If the criteria used to discharge patients from the PACU are met in the OR, it would be appropriate to consider bypassing the PACU and transferring the patient directly to the step-down unit. This process is known as "fast-tracking" after ambulatory surgery.⁸

Sevoflurane undergoes temperature dependent degradation by baralyme and soda lime. Sevoflurane produces a dose-dependent decrease in arterial blood pressure due to peripheral vasodilatation. It does not sensitize the heart to arrhythmias or cause coronary artery steal syndrome. Due to its low solubility in blood it can be used for rapid induction of anaesthesia without intravenous anaesthetics. This is one of the reasons why it is currently replacing halothane for mask induction.⁹

Induction of anaesthesia can be achieved by using 1.5 to 3% sevoflurane in air or in oxygen, or by using 0.7 to 2% sevoflurane in 65% nitrous oxide. Sevoflurane does not cause coughing and excitation during induction and can be used without intravenous anaesthetics. Maintenance of anaesthesia can be achieved with 0.4 to 2% sevoflurane.

Desflurane is a nonflammable fluorinated methyl ethyl ether. It has a vapor pressure of 673 mmHg at 20°C and boils at 23.5°C. The

blood/gas coefficient is 0.42 and the MAC in 100% oxygen is 6.071 and addition of 60% Nitrous Oxide to O₂ decreases MAC to 2.8.⁹

Induction of anaesthesia can be achieved by using 6 to 10% desflurane in air or in oxygen, or by using 5 to 8% desflurane in 65% nitrous oxide. Maintenance of anaesthesia can be achieved with 5 to 7% desflurane. The low tissue solubility of desflurane results in rapid elimination and awakening.⁹

The introduction of less soluble inhaled anaesthetics desflurane and sevoflurane, has added a new dimension to recovery and fast-tracking¹⁰⁻¹² by allowing more rapid recovery and earlier discharge home.

MATERIALS AND METHODS

A double blind randomised study in the Department of Anaesthesiology and Intensive Care Unit at Govt. Medical College, Amritsar. 100 patients of American Society of Anaesthesiologist grade I or II in the age group of 20 to 50 years undergoing short surgical procedure under general anaesthesia were included in this study.

Inclusion criteria: Patient of ASA grade I or II age between 20-50 years admitted in Department of Surgery, Govt. Medical College, Amritsar irrespective of gender.

Exclusion criteria for potential subjects were:

- History of a significant cardiac, pulmonary, hepatic or renal disease.
- Chronic drug or alcohol abuse.
- Disabling neuropsychiatric disorder.
- Women who were pregnant or breast-feeding.

After approval from the institutional ethical committee and informed written consent of parents/guardians of the patients were taken. These patients were randomly allocated in two groups of 50 each.

Allocation of Groups:

Group-S (50): Patients were induced with propofol and maintained with Sevoflurane + Dexmetomidine+O₂+N₂O without using muscle relaxant.

Group-D (50): Patients were induced with propofol and maintained Desflurane+Dexmetomidine+O₂+N₂O without using muscle relaxant.

Visual Linear Analogue Scale for Pain

The interpretations of visual linear analogue scale was explained one day before the operation to the selected patients taken for study to determine the analgesia in the postoperative period. This was carried out with 0-10 cm line. The first end mark '0' means 'no pain' and the end marked '10' means 'severe pain'. The patients were asked to mark the severity of pain experienced. Rescue analgesia was given with Inj. Diclofenac 75mg i.m. if VAS score >3.

Anaesthesia Technique

On the day of surgery patients were reassessed preoperatively. After confirming overnight fasting and patients were shifted to operation theatre. Multipara monitor were attached. Base line reading of heart rate, SpO₂, NIBP and ECG pattern were recorded and continuous monitoring of vitals started.

In group S (Sevoflurane + Dexmedetomidine) after securing two IV line ringer lactate started. After giving premedication, Patients were induced with Dexmedetomidine 1µgm/Kg over 10 min and Inj. Propofol 2-3mg/Kg. On achieving full induction I-GEL was

inserted. Maintenance of anaesthesia was achieved with sevoflurane 2-3% and Dexmedetomidine infusion 0.5 µg/kg/hour. Dial concentration was adjusted to maintain BIS in range of 40-50. In case of intraoperative bradycardia i.e. HR<60 beats/min or hypotension (SBP<90 or MBP<60mmHg).i.e. dial concentration and Dexmedetomidine infusion rate will be adjusted accordingly. Inj. Atropine and Inj. Ephedrine were used for resistant cases. 10 minutes before the start of skin closure Inj. Paracetamol infusion was started at a dose of 15mg/kg for analgesia. Dexmedetomidine infusion stopped 5 minutes before completion of surgery after completion of surgery all anaesthetic gases were stopped, I-GEL was removed 100% O₂ given and emergence time was noted. Emergence commences on discontinuation of the anaesthetic agent, which allows the patient to awaken, recover protective airway reflexes, and resume motor activity. Emergence time starts from stopping of anaesthesia upto when patient awakes, recover protective airway reflexes, and resume motor activity. Similar anaesthetic technique was used in group D except that, maintenance of anaesthesia was done with O₂+N₂O+Desflurane + Dexmedetomidine.

Monitoring

Continuous monitoring of vitals was started after attaching Multipara monitor. In first 15 minutes of intra-operative period monitoring of BP, HR, SPO₂ and ECG pattern were done every 5 minutes after that time interval was changed to 10 minutes till completion of surgery. After completion of surgery emergence time was noted. In recovery room assessment of variables required for fast track scoring system were recorded after every 5 minutes which includes.

- Physical activity
- Hemodynamic stability
- Respiratory stability
- Oxygen saturation status
- Postoperative pain assessment

On achieving a minimal score of 12 in fast track scoring system (with no score <1 in any individual category) patients were transferred to day care surgery unit.

All the results were be compiled, analyzed statistically and the appropriate test was applied and the blinding of the study was opened at the end.

Table 1: Showing Age Distribution

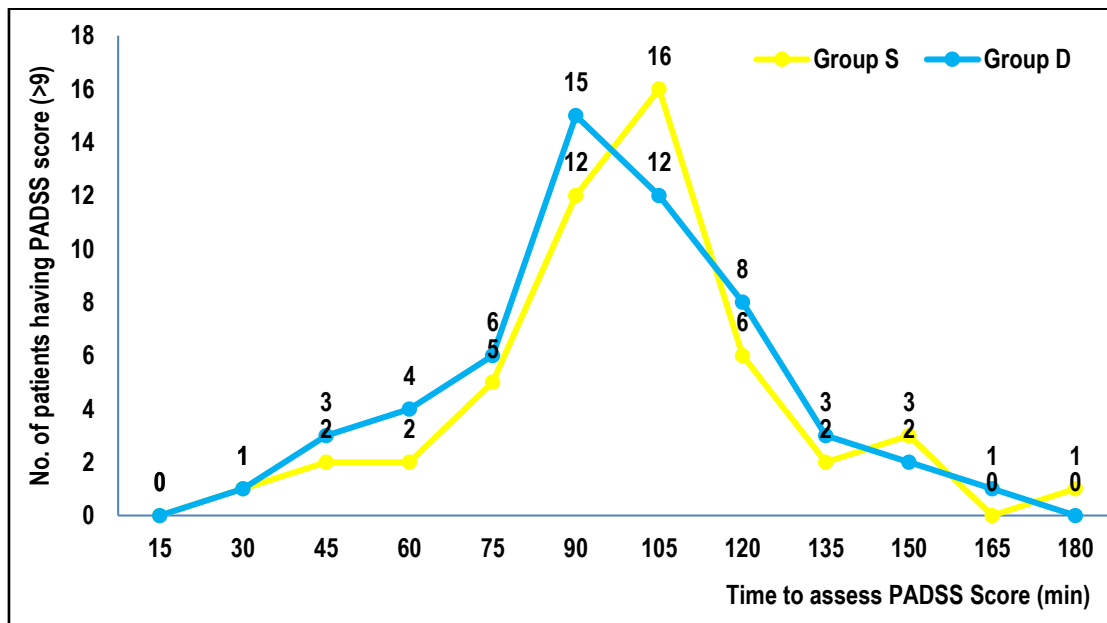
Age group (years)	GROUP S		GROUP D	
	No.	%	No.	%
20-30	15	30.0	20	40.0
31-40	10	20.0	10	20.0
>50	25	50.0	20	40.0
Total	50	100	50	100
X²		1.27		
Df		2		
P-value		0.530 ^{NS}		

Table 2: Showing Duration of Surgery

Duration (minutes)	GROUP S		GROUP D	
	No.	%	No.	%
0-30	1	2.0	2	4.0
31-60	31	62.0	36	72.0
61-90	18	18.0	12	24.0
Total	50	100.0	50	100.0
Mean		55.1		52.6
X²		1.91		
Df		2		
P-value		0.385 ^{NS}		

Table 3: Fast Track Score in Group S and D

Fast track score	GROUP S		GROUP D		t-value	p-value
	Mean	SD	Mean	SD		
5	9.460	1.7867	9.660	1.1661	-0.647	0.519
10	11.520	1.2656	11.660	1.2731	-0.541	0.590
15	12.480	1.0349	12.660	0.7598	-0.969	0.335
20	13.460	0.6131	13.681	0.6292	-1.751	0.083
25	13.820	0.3881	13.894	0.3117	-1.026	0.307



Graph 1: No. of Patients Having PaddS Score >9 (Fulfilling Discharge Criteria) at Different Time Interval in Group S and D

RESULTS

Our study showed that the mean age of patients in both the groups was found to be statistically insignificant ($p > 0.05$) (table 1). The mean duration of surgery in both the groups was found to be statistically insignificant ($p > 0.05$).

Our study shows that fast track score in group S and D at different time interval was statistically insignificant ($p > 0.05$) (table 3). The maximum number of patients achieving PADSS score between 60-120 minutes. 83% patients were ready to go home at 120 minutes (graph 1).

DISCUSSION

For day care anaesthesia, the use of anaesthetics that provide fast and smooth induction, allow fast changes in intensity while maintaining anaesthesia, early recovery and have no or minimal postoperative side effects are suggested. Various inhalational agents were used during the last century. They were followed by ethylene, cyclopropane, trichloroethylene, isopropenyl vinyl ether and others, until halothane was synthesized in 1951 and subsequently introduced into clinical practice in 1956. Considering these characteristics, fast induction and early recovery based on low blood/gas partition coefficients is expected from newer inhalational agents sevoflurane and desflurane compared with traditional agents like isoflurane, and halothane.

All two groups were comparable demographically and statistically non-significant in terms of mean age and sex of patients in two groups.

Intraoperative haemodynamic variables such as heart rate, blood pressure and oxygen saturation were monitored and remained stable during surgery and also the intergroup comparison was statistically non-significant and this comes in agreement with the study conducted by Jones et al.¹³

Gergin et al¹⁴ studied the haemodynamics of sevoflurane with those of desflurane in nitrous oxide anaesthesia and concluded that both the groups did not differ in haemodynamic measures.

Ravi Jindal et al¹⁵ studied maintenance and emergence characteristics after desflurane or sevoflurane in outpatient

anaesthesia they also concluded that there was no statistical difference in the intraoperative heart rate, mean systolic blood pressure and mean diastolic blood pressure between the groups.

Our study is also in accordance with study done by Rao SH et al¹⁶. In their study baseline and at time of intubation HR, SBP and DBP were 80.5 ± 15.14 , 134.3 ± 18.46 , 81.4 ± 10.81 and 73.4 ± 11.93 , 123.8 ± 19.02 , 76.0 ± 10.05 respectively. They concluded that dexmedetomidine provided a stable haemodynamic profile in the perioperative period and a blunted pressor response to intubation and extubation.

The time to achieve response to painful stimuli, response to verbal commands and spontaneous eye opening were measured from time of termination of anaesthetic gases. Time (mean \pm SD minutes) for response to painful stimuli, response to verbal commands and spontaneous eye opening was 5.38 ± 1.04 , 5.96 ± 1.14 and 6.84 ± 1.05 in group S (sevoflurane), in group D (desflurane) it was 3.66 ± 0.96 , 4.64 ± 1.04 and 5.62 ± 1.08 respectively. All these parameters were achieved in significantly less time (p value < 0.0001) in group D (desflurane) as compared to group S (sevoflurane) thus suggesting that desflurane had faster recovery from anaesthesia than sevoflurane.

Dupont et al¹⁷ showed that time (mean \pm SD minutes) for eye opening was 7.2 ± 4.8 , 13.7 ± 8.6 and 14.3 ± 11.0 in desflurane, sevoflurane and isoflurane groups respectively and extubation time was 8.9 ± 5.0 , 18.0 ± 17.0 and 16.2 ± 11.0 in desflurane, sevoflurane and isoflurane groups respectively. They concluded that desflurane showed faster emergence and recovery times than sevoflurane and isoflurane. So our study is also in accordance with this.

Our study is also in accordance with a study done by Isik Y et al¹⁸ concluded that low flow desflurane and sevoflurane anaesthesia do not adversely affect haemodynamic parameters, hepatic and renal function in children. The recovery time was shorter in the desflurane group compared to the sevoflurane and desflurane may be preferred when early recovery from anaesthesia is warranted.

The fast track score was checked at 5 minutes after removing I-GEL. The time to achieve fast track score ≥ 12 and fast track score at different time interval were recorded during the study. The mean time to achieve fast track score of ≥ 12 was less in group D (12.8 ± 2.88 min) as compared to group S (12.9 ± 4.52 min) and it was statistically non-significant. The fast track score at 5, 10, 15, 20 and 25 minutes was also statistically insignificant between group D (9.6 ± 1.16 , 11.66 ± 1.27 , 12.68 ± 0.75 , 13.68 ± 0.62 and 13.89 ± 0.311) and group S (9.46 ± 1.78 , 11.52 ± 1.26 , 12.48 ± 1.03 , 13.46 ± 0.61 and 13.82 ± 0.38). This is in accordance with the study conducted by Gonul T. Keles et al¹⁹ who showed that there was no significant variation in FTC score between sevoflurane (10.5 ± 1.8 , 12.2 ± 1.2 and 12.7 ± 0.9) and desflurane (10.8 ± 2.0 , 12.7 ± 1.5 and 12.9 ± 1.4) at 5, 10 and 15 minutes after extubation. In our study results were 9.6 ± 1.16 , 11.66 ± 1.27 and 12.68 ± 0.75 (in group D) 9.46 ± 1.78 , 11.52 ± 1.26 and 12.48 ± 1.03 (in group S) at 5, 10 and 15 minutes which were insignificant.

This finding is supported by study done Loop et al.²⁰ they confirmed the results of this study and they showed that despite faster early recovery and less need for postoperative analgesic and antiemetic medication, the late recovery was comparable among the remifentanyl based desflurane, sevoflurane or propofol groups as there was no statistically significant difference in PACU stay in minutes [median(range)] 43 (36–96), 44 (36–94) and 37 (35–67) desflurane, sevoflurane and propofol groups respectively. This was also in concordance with the study conducted by J.E. Heavner et al²¹ who showed that intermediate recovery, as measured by the digital symbol subtraction test and time to ready for discharge from the PACU was similar sevoflurane and desflurane.

Our study is also supported by study done by Ravi jindal et al.¹⁵ They concluded there was insignificant difference in mean time to achieve PADSS score ≥ 9 between desflurane (188.40 ± 22.30 min) and sevoflurane (193.20 ± 22.60 min) groups.

The reason for delayed achieving PADSS score ≥ 9 in 16 patients was type of surgery due to which they were not able to walk such as hydrocele, perineal abscess drainage etc.

CONCLUSION

We concluded that both the inhalational anaesthetics i.e. sevoflurane and desflurane provide similar haemodynamic stability, but desflurane is associated with faster emergence as compared to sevoflurane. It should be considered that these anaesthetics have no differences in terms of late recovery, postoperative nausea and vomiting and discharge from the hospital.

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