



STUDY OF RECOVERY CHARACTERISTICS AND HEMODYNAMIC PARAMETERS AFTER USING SEVOFLURANE OR DESFLURANE IN SPINE SURGERIES

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ABSTRACT

BACKGROUND: Spine surgeries are associated with intraoperative cardiovascular instability and there is significant intraoperative blood loss. Rapid recovery is desirable after a spine surgery as it enables early post-operative neurological evaluation and prompt management of complications. Inhaled anaesthetic agents like sevoflurane and desflurane have low blood gas partition coefficients and thus share the advantage of faster onset and neutralize of anesthetic effect as compared with older inhaled anaesthetic agents.

METHODS: The study was conducted in Lokmanya Tilak municipal medical college and general hospital, Mumbai. It is a randomized prospective study with 88 patients meeting inclusion criteria in all patients following parameters duration of surgery, level of spine surgery, hemodynamic parameters and recovery characteristics was recorded and evaluated.

RESULTS: We conclude that compared to sevoflurane, desflurane provides stable hemodynamic parameters and early recovery and emergence from anesthesia when in spine surgeries.

CONCLUSION: We conclude that desflurane provides stable hemodynamic parameters and early recovery and emergence from anesthesia compared to sevoflurane in spine surgeries.

KEYWORDS: Spine Surgery, Desflurane, Sevoflurane, Recovery Characteristics.

INTRODUCTION

Anesthesia for major spinal surgery, such as spinal stabilization following trauma or neoplastic diseases presents a number of challenges. Procedures like microdiscectomy, to long duration surgeries involving spine at multiple levels and significant blood loss. Surgery cause stress with significant blood loss and prolonged anaesthesia.

An ideal anaesthetic agent should provide smooth and rapid induction, optimal operating conditions and rapid recovery with minimal side effects like nausea, vomiting and postoperative pain. Inhaled anaesthetics allow rapid emergence from anaesthesia because of easy titratability with inherent neuromuscular blocking effects.^[1]

Inhaled anaesthetic agents like sevoflurane and desflurane have low blood gas partition coefficients and therefore share the advantage of faster onset and offset of anaesthetic effect as compared with older inhaled anaesthetic agents.^[2] The pharmacokinetic properties of desflurane and sevoflurane favour better intraoperative control of anaesthesia and a rapid postoperative recovery. They have significantly lower blood/gas partition coefficients (0.45 and 0.65 respectively)^[2] which offers rapid induction and emergence from anaesthesia. Hence these anaesthetic agents are suitable for spine surgeries. The emphasis in present clinical practice is to facilitate early awakening along with improved quality of emergence. Early awakening allows for a timely detection of a neurological complication and reintervention if necessary.^[3] The emergence time, which should be considered reasonable to facilitate early neurological evaluation has been suggested as 15 mins^[3] The purpose of this prospective study is to assess the emergence characteristics after anaesthesia with sevoflurane or desflurane for spine surgeries. The aim is to analyse and compare the superiority of each agent, with regards to faster emergence, early and intermediate recovery. The intraoperative haemodynamic profile and postoperative side effects of the two agents will also be analysed.

AIMS AND OBJECTIVE

Study of recovery characteristics and hemodynamic parameters after using sevoflurane or desflurane in spine surgeries.

To study early and intermediate recovery characteristics.

To study haemodynamic parameters and their changes.

MATERIALS AND METHOD

Study Design

Randomized Prospective Study.

Place and Area of Study

Orthopaedic Operating theatres of Tertiary Care Hospital.

Duration of Study

November 2017- August 2019.

Sample Size

88

Inclusion Criteria

- All patients electively posted for spine surgery giving consent for participation in observational study.
- Age 18-65 years.
- ASA – I, II, III
- Duration of surgery 4-6 hrs.
- Thoracic and lumbar spine surgeries.

Exclusion Criteria

- Patients undergoing emergency spine surgeries.
- Patients who are not giving consent for participation in study.
- Chronic alcoholic or narcotic drug abuse.
- Uncompensated cardiopulmonary disease, hepatic and renal dysfunction
- Pregnant females.

RESULTS

Gender	Group	
	Desflurane (n=44) n (%)	Sevoflurane (n=44) n (%)
Female	16 (36.4)	20 (45.5)
Male	28 (63.6)	24 (54.5)
Chi-Square Test, P Value = 0.386, Not Significant		

Table 1 : Association between Study Group and Gender (N=88)

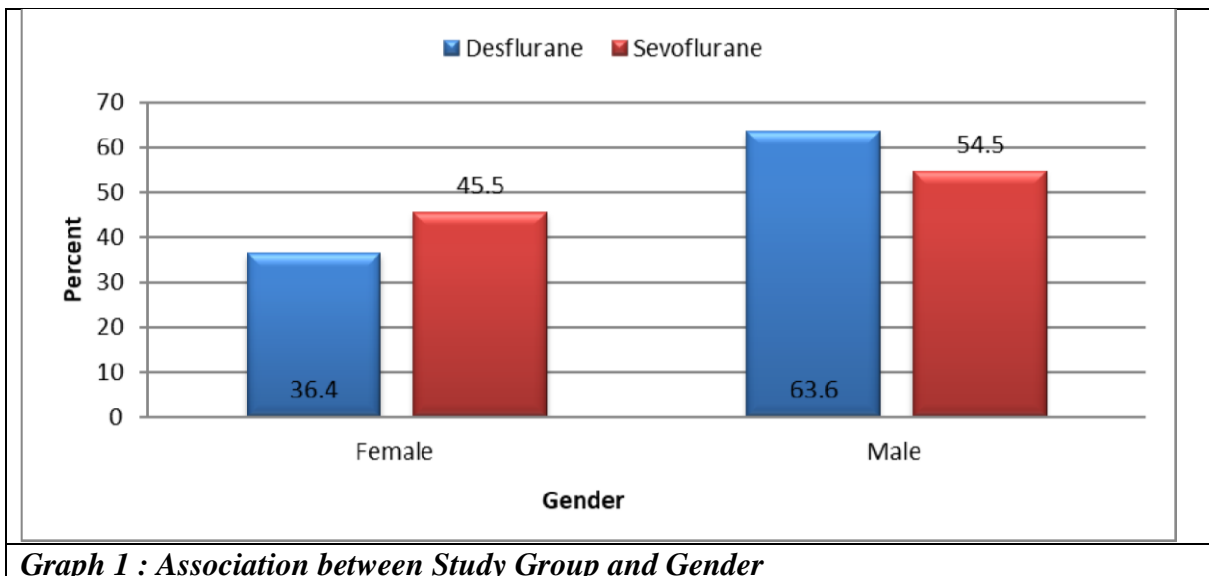
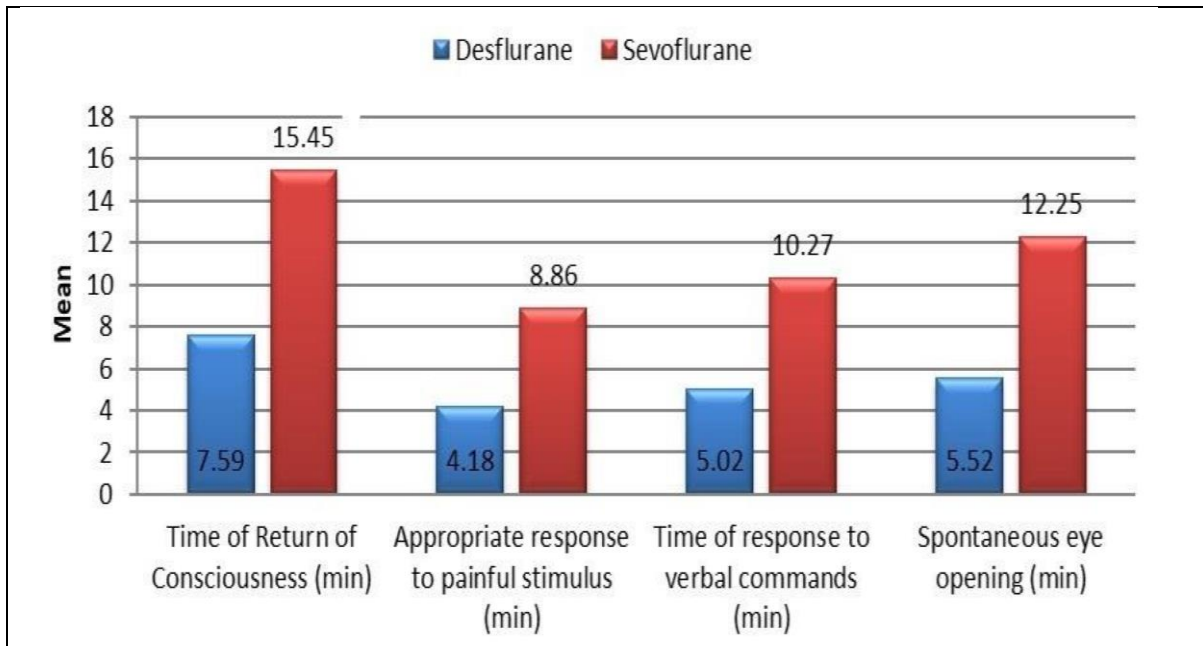


Table 1 and graph 1 shows demographic data of our study. It shows that 36.4% females in the study received desflurane as the maintenance agent while 45.5% females received sevoflurane as the maintenance agent. 63.6% males received desflurane and 54.5% males received sevoflurane as the maintenance agent. P value is not statistically significant. Data is comparable.

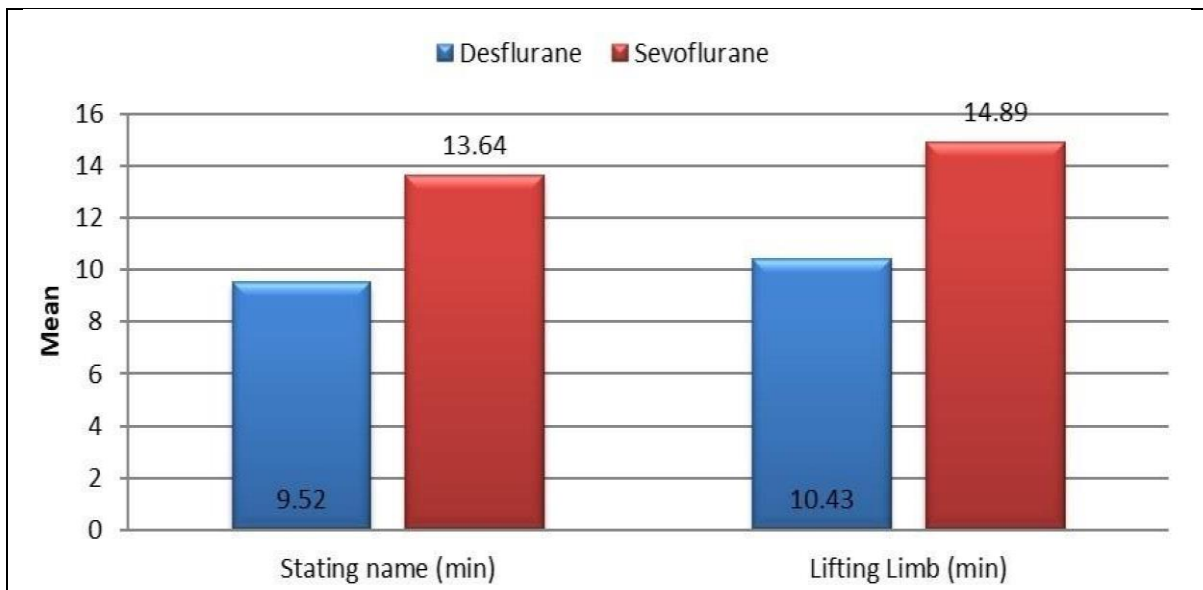
Level of Spine Surgery	Group	
	Desflurane (n=44) n (%)	Sevoflurane (n=44) n (%)
D6-7	1 (2.3)	-
D6-8	1 (2.3)	-
D8	1 (2.3)	-
D7-8	-	1 (2.3)
D8-9	2 (4.5)	4 (9.1)
D10	-	1 (2.3)
D10-11	2 (4.5)	2 (4.5)
D11	-	2 (4.5)
D11-12	1 (2.3)	3 (6.8)
D12	-	2 (4.5)
D8-10	2 (4.5)	1 (2.3)
D8-11	-	1 (2.3)
D9-D10	2 (4.5)	2 (4.5)
D9-11	1 (2.3)	-
L1-2	1 (2.3)	1 (2.3)
L2-3	3 (6.8)	2 (4.5)
L3-4	6 (13.6)	6 (13.6)
L3-5	-	1 (2.3)
L4	-	1 (2.3)
L4-5	14 (31.8)	9 (20.5)
L5-S1	7 (15.9)	5 (11.4)
Chi-Square Test, P Value = 0.677, Not Significant		
Table 2: Association between Study Group and Level of Spine Surgery (N=88)		

Table 2 shows association between the level of spine surgery and the study group. 2.3% of patients undergoing surgery at D6-7, D6-8, D8, D11-12, D9-11, L1-2 levels, 4.5% at D8-9, D10-11, D8-10, D9-10 levels, 6.8% at L2-3, 13.6% at L3-4, 31.8% at L4-5 and 15.9% at L5-S1 levels received desflurane as maintenance agent. 2.3% of patients undergoing surgery at D7-8, D8-10, D8-11, L1-2, L4, L3-5 levels, 9.1% at D8-9 levels, 4.5% at D9-10, D10-11, D11, D12, L2-3 levels, 6.8% at D11-12, 13.6% at L3-4 levels, 20.5% at L4-5 level and 11.4% at L5-S1 levels received sevoflurane as maintenance agent. P value is not statistically significant. Data is comparable.

Parameter	Group		P Value
	Desflurane (n=44) Mean (SD)	Sevoflurane (n=44) Mean (SD)	
Blood Loss (ml)	448.86 (112.31)	451.14 (79.59)	0.913
Urine Output (ml)	443.18 (39.75)	437.50 (39.06)	0.501
Time of Return of Consciousness (min)	7.59 (0.72)	15.30 (1.15)	<0.001*
Appropriate response to painful stimulus (min)	4.18 (0.65)	8.86 (0.66)	<0.001*
Time of response to verbal commands (min)	5.02 (0.62)	10.27 (0.94)	<0.001*
Spontaneous eye opening (min)	5.52 (0.66)	12.25 (1.31)	<0.001*
Stating name (min)	9.52 (0.79)	13.64 (1.18)	<0.001*
Lifting Limb (min)	10.43 (0.58)	14.89 (1.03)	<0.001*
Modified Aldrete Score at 5 min	7.36 (0.53)	6.41 (0.54)	<0.001*
Modified Aldrete Score at 10 min	8.50 (0.55)	7.68 (0.80)	<0.001*
Unpaired t Test, P Value *Significant			
Table 3: Comparison of Various Parameters between 2 Study Groups (N=88)			



Graph 2 : Association between Study Group and Response Parameters



Graph 3 : Association between Study Group and Response Parameters

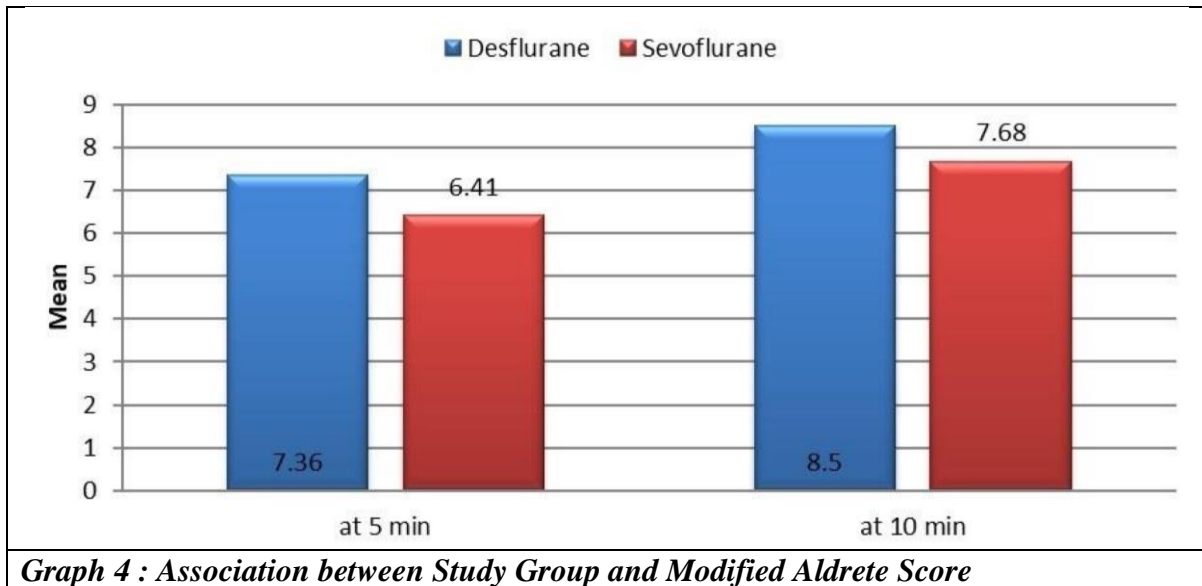


Table 3, graph 2 and graph 3 shows comparison between various response parameters of recovery characteristics in the two study groups. The mean time for return of consciousness in desflurane group was 7.5 mins and in sevoflurane group was 15 mins, mean time for appropriate response for painful stimulus was 4 mins in desflurane group and 8 mins in sevoflurane group. The mean time for response to verbal commands, spontaneous eye opening, stating name and lifting limb was 5 mins, 5 mins, 9 mins and 10 mins in desflurane group respectively and it was 10 mins, 12 mins, 13 mins and 14 mins in sevoflurane group respectively. The p value is statistically significant in these response parameters. Graph 4 shows comparison of modified Aldrete score in the two study groups. It shows the recovery score at 5 mins and 10 mins intervals. The mean score at 5 mins and 10 mins in desflurane group was 7 and 8 respectively while it was 6 and 7 at same intervals in sevoflurane group. The p value is statistically significant.

DISCUSSION

Spine surgeries are associated with intraoperative cardiovascular instability and there is significant intraoperative blood loss. Surgery imposes stress of major blood loss and prolonged anaesthesia. The key anaesthetic considerations are intraoperative hemodynamic stability and early recovery from anaesthesia.^[4]

Spine surgery initiates a complex stress response comprising of metabolic, neuroendocrine and inflammatory changes, which result in the activation of sympathetic system and a catabolic state. These sequelae lead to delayed postoperative recovery. Enhanced postoperative recovery is measured by the type of anaesthesia, time taken for complete recovery, length of hospital stay, morbidity and mortality.^[5]

Rapid recovery is desirable after a spine surgery as it enables early post-operative neurological evaluation and prompt management of complications.^[1] One of the major factors that determines speed of recovery from anaesthesia is the choice of anaesthetic technique. An ideal anaesthetic agent should provide smooth and rapid induction, optimal operating conditions and rapid recovery with minimal side effects like nausea, vomiting and postoperative pain.

Early recovery can be assessed by time of return of consciousness (min), appropriate response to painful stimulus (min), time of response to verbal commands (min), spontaneous eye opening (min), stating name (min), lifting Limb (min) and Modified Aldrete Score recorded at 5 and 10 min takes in consideration different parameters: airway, breathing, circulation, consciousness and saturation which helps for assessment of recovery following surgery.

Palak A Chudasama et al^[6] studied the comparison of recovery characteristics and hemodynamic parameters between desflurane and sevoflurane in day-care surgical procedure. They concluded that

desflurane had significantly better hemodynamic stability, postoperative recovery and less post-operative complications compared to sevoflurane.

Gulcan Berkel et al^[7] in their study compared hemodynamic parameters and recovery characteristics between desflurane and sevoflurane in the patients undergoing laparoscopic cholecystectomy concluded that both desflurane and sevoflurane maintains hemodynamic stability during the intraoperative period. They also found that early recovery was rapid in desflurane group.

However a study done by Shan J et al^[8] in comparison of the neuroprotective effects and recovery profiles of isoflurane, sevoflurane and desflurane on neurosurgical pre-conditioning on ischemia/reperfusion cerebral injury concluded that sevoflurane had greater hemodynamic stability than other potent inhaled agents.

Post-Operative Recovery Profiles

Our study measured post-operative recovery profiles which included time of return of consciousness (min), appropriate response to painful stimulus (min), time of response to verbal commands (min), spontaneous eye opening (min), stating name (min), lifting Limb (min), modified Aldrete Score at 5 min and at 10 min which included parameters: airway, breathing, circulation, consciousness and saturation. We observed significant early and intermediate recovery characteristics in desflurane group compared to sevoflurane group. Ravi Jindal et al^[9] studied the comparison of maintenance and emergence characteristics after desflurane or sevoflurane in outpatient anaesthesia. Their aim was to analyse and compare the superiority of each agent, with regards to faster emergence, early and intermediate recovery. They found out that the emergence and early recovery time was shorter after maintenance of anaesthesia with desflurane compared with that of sevoflurane. Rörtgen D et al^[10] conducted a double-blinded randomized controlled trial for comparison of early cognitive function and recovery after desflurane or sevoflurane anaesthesia in the elderly. In their study emergence was found to be significantly faster in the desflurane group for 'time to open eyes' and 'time to extubation'. White PF et al^[11] studied desflurane versus sevoflurane for maintenance of outpatient anaesthesia, the effect on early versus late recovery and perioperative coughing. They concluded that use of desflurane for maintenance of anaesthesia was associated with a faster emergence than sevoflurane.

The study done by Ryan C Romeo et al^[12] demonstrates that there is no difference in anaesthesia wake up times between sevoflurane and desflurane in morbidly obese laparoscopic bypass patients.

A study done by Vellejo M C et al^[13] in morbidly obese patients undergoing laparoscopic gastroplasty, emergence, as measured by time to eye opening, did not differ between desflurane and sevoflurane, with similar recovery characteristics.

A comparison between sevoflurane and desflurane anaesthesia in patients undergoing craniotomy for supratentorial intracranial surgery was done by Magni G et al^[14] They concluded that patients who received desflurane had a shorter extubation and recovery time but similar intraoperative and postoperative incidence of complications compared with those who received sevoflurane.

Meta-analysis of studies done by Macario A et al^[15] in which the duration of anaesthesia was up to 3.1 hours shows that patients receiving either sevoflurane and desflurane had no significant differences in post anaesthesia care time or post operative nausea and vomiting but, patients receiving desflurane obeyed commands were extubated and were oriented 1.0-1.2 min earlier than those receiving sevoflurane.

CONCLUSION

Early and intermediate recovery characteristics were found to be better in desflurane than sevoflurane. Desflurane and sevoflurane both provide stable hemodynamic parameters in intra-operative period but statistically desflurane was found to have better results. We conclude that desflurane provides stable hemodynamic parameters and early recovery and emergence from anaesthesia compared to sevoflurane in spine surgeries.

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