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Comparative evaluation of haemodynamic parameters intra operatively during desflurane or sevoflurane anaesthesia

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Abstract
Background and Aim: Sevoflurane and Desflurane are the inhalation anaesthetic agents are the most frequently used drugs for giving general anaesthesia to the patients. The purpose of this study was to evaluate desflurane and compare it with sevoflurane in terms of intraoperative haemodynamic stability and any other side effects noted in elective laparoscopic surgeries.
Methods: A prospective randomized controlled study was conducted over 60 ASA I-III patients posted for laparoscopic surgeries. Basal HR, SBP, DBP, Oxygen saturation were noted. Patients were pre-medicated and induced and were maintained on inhalation agents according to the group allocated. Haemodynamic parameters were recorded at 1, 5, 10 minutes after intubation and then every 15 minutes throughout the operative period. After extubation, patients were monitored and treated for complications such as hypo/ hypertension, tachy/bradycardia. Incidence of cough, nausea, vomiting, sore throat, laryngospasm, blood on device, lip and dental trauma were noted. Haemodynamic parameters and side effects were compared amongst both groups.
Results: We observed no statistically significant difference in heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure between the groups at any time interval (p>0.05). All the patients were observed for side effects and adverse effects during perioperative period. None of the patients in either group had side effects like hypotension, bradycardia, nausea, vomiting, arrhythmias, shivering, cough, sore throat.
Conclusion: Desflurane and sevoflurane when compared as a maintainance agent during laparoscopic surgery were comparable with respect to intraoperative haemodynamics parameters and perioperative complications.

Keywords: sevoflurane, desflurane, haemodynamics

Introduction
Introduction of safe anaesthesia has been the turning point for medical history 150 years ago. It has changed the course of modern medicine completely. Application of surgical field improved and expanded vastly which also helped in gradually expanding the scope of anaesthesia with various techniques of regional anaesthesia [1].
General anaesthesia is the reversible suppression of the consciousness due to depression of central nervous system by administration of various drugs resulting in loss of perception and response to all external stimuli. It is the most common form of anaesthesia and is being practised in day to day surgeries. Fast recovery and early discharge with minimal morbidity is desired by every patient. It improves efficiency and reduces the cost of health care facility. Laparoscopic surgeries are performed on day care basis which leads to early mobility and reduced hospital stay but the associated pneumoperitoneum with laparoscopic surgery may lead to intraoperative haemodynamic instability. An ideal anaesthetic agent for laparoscopic procedures should provide intraoperative haemodynamic stability with early recovery. Thus choice of anaesthetic agent should be made with lots of thought as there are newer and various drugs available to choose from. Inhalation anaesthetic agents are the most frequently used drugs for giving general anaesthesia to the patients. Only a fraction of this inhalation agent is added to the fresh gas supply which is delivered via the anaesthesia machine. Other adjuvant agents such as benzodiazepines, opiods and others are supplemented mostly by intravenous route to leading to a balanced anaesthesia, giving analgesia, amnesia, and hypnosis. They are preferred for day care surgery because of their easy availability and ease of administration and the ability to reliably monitor their effects with both clinical signs and end tidal concentration with predictable recovery [1].

With the easy access and availability of inhalation agents with lower blood solubility such as sevoflurane and desflurane, they are better suited for outpatient surgeries and are replacing the traditional volatile agents due to their faster emergence and recovery from general anaesthesia [2, 3]. The purpose of this study was to evaluate desflurane and compare it with sevoflurane in terms of intraoperative haemodynamic stability and any other side effects noted in elective laparoscopic surgeries.

Method

A prospective randomized controlled study was conducted over 60 ASA I-III patients aged 18 to 60 years posted for laparoscopic surgeries under general anaesthesia. Patients were randomly and equally allotted to either group D and group S by computer based randomised system.

Pre-anaesthetic check-up was done a day before surgery and written informed consent was taken. Patients with cardiopulmonary risk, hepatic or renal dysfunction, neurological or psychiatric disorders, those with allergies to study drug or drug abuse, pregnant females, obese patients with BMI > 30, known difficult airway, cervical spine disease patient and patients who will not give consent to be part of study were not included in the study.

The day, patient was posted for surgery, after securing intravenous line pre-medication was given. Patients were pre-medicated with injection midazolam 1-2mg i.v., inj glycopyrolate 0.2mg i.v., inj tramadol 75 mg i.v. and inj. emset 4mg i.v. In operation theatre, basal HR, SBP, DBP, Oxygen saturation were noted. Patients were induced with inj propofol 1 to 2.5mg/kg i.v and inj scoline 1 to 1.5mg/kg. Haemodynamic parameters like HR, SBP, DBP, MAP and SPO2 were recorded at 1,5,10 minutes after intubation and then every 15 minutes throughout the operative period. Patient was maintained on inj. vecuronium (intermittent) and inhalational agent according to the group allocated to him/her.

Group D: Patients were maintained on O2 + N2O + Desflurane (3 to 6%)

Group S: Patients were maintained on O2 + N2O + Sevoflurane (0.6 to 2%)

To maintain HR and MAP within 20% of baseline, inspired concentration of inhalational agent was increased by 50% in stepwise manner upto 6% in desflurane group and 3% in sevoflurane group. If hypertension and tachycardia persisted even after 2 consecutive increase in dial concentration, inj. fentanyl 50 ug iv was given. If it still persisted, then inj. metoprolol 1mg i.v was given. If hypotension (MA*P*<20% of baseline) or bradycardia (HR<20% of baseline value) occurred, dial concentration was decreased or stopped if needed, and iv fluid administration was increased. If it still persisted, ephedrine was given in a small bolus dose of 6 mg. If HR was < 40/min or caused haemodynamic instability, Inj. atropine 0.6 mg iv was given.

After surgery patients were reversed with inj neostigmine 0.05mg/kg i.v and inj. glycopyrrolate 0.008mg/kg i.v. Just before the reversal of neuromuscular blockade inhalational agent was stopped abruptly. After extubation, patients were monitored and treated for complications such as hypo/ hypertension, tachy/bradycardia. Incidence of cough, nausea, vomiting, sore throat, laryngospasm, blood on device, lip and dental trauma were noted. Haemodynamic parameters and side effects were compared amongst both groups.

Observations and Results

We conducted a prospective randomized controlled study on 60 patients of ASA class I, II and III belonging to age group 18 to 60 years scheduled for laparoscopic surgery under general anaesthesia. All data were presented as mean and standard deviation (SD), except where specified. Data were analyzed using computer statistical software system open epi (open source epidemiological statistics for public health). The unpaired t-test and chi-square test were used for intergroup and intra-group comparisons. Probability values $p>0.05$ were considered not significant, $p<0.05$ were considered significant and $p<0.001$ were considered highly significant.

Demographic profile and duration of anaesthesia as well as surgery was found to be comparable in both groups. The mean age of patients in group D was 34.70 ±11.80 years while it was 35.20 ±13.40 years in group S ($p>0.05$). The mean weight of patients in desflurane group was 56.83 ±3.55 kgs while it was 58.30 ± 4.24 kgs in group sevoflurane ($p>0.05$). The male: female ratio was found to be same in both groups of 24 : 6. Thus, both the groups were comparable with respect to age, weight and sex ratio. The mean duration of anaesthesia observed was 137.71 ± 41.30 minutes in desflurane group and 144.40 ± 54.20 minutes in group sevoflurane ($p>0.05$).

Six out of 30 patients in desflurane group and 4 out of 30 patients in sevoflurane group developed hypertension and required fentanyl 50microgram; while 1 out of 30 patients in desflurane group and 1 out of 30 patients in sevoflurane group required metoprolol 1mg i.v., the difference was statistically not significant ($p>0.05$).

We observed no statistically significant difference in heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure between the groups at any time interval ($p>0.05$).

All the patients were observed for side effects and adverse effects during perioperative period. None of the patients in either group had side effects like hypotension, bradycardia, nausea, vomiting, arrhythmias, shivering, cough, sore throat.

Table 1: Mean Heart Rate

	Group D	Group S	P value
base line	92.81(±13.70)	92.30(±12.11)	$p>0.05$
post induction	99.21(±12.80)	100.30(±14.61)	$p>0.05$
1 min after intubation	102.30(±12.40)	103.51(±13.30)	$p>0.05$
5 min after intubation	95.7(±12.22)	91.7(±12.91	$p>0.05$
at skin incision	93.51(±13.11)	94.80(±10.60)	$p>0.05$
5 min after incision	89.40(±13.31)	90.21(±13.11)	$p>0.05$
10 min after incision	86.70(±11.10)	87.81(±11.11)	$p>0.05$
30 min after incision	84(±10.71)	85.10(±9.60)	$p>0.05$
45 min after incision	81.91(±10.50)	82.90(±8.91)	$p>0.05$
60 min after incision	81.91(±10.51)	82.80(±8.80)	$p>0.05$
75 min after incision	81.20(±9.20)	83.21(±9.50)	$p>0.05$
90 min after incision	83.02(±8.01)	83.80(±10.41)	$p>0.05$
105 min after incision	82.81(±8.40)	80.11(±1021)	$p>0.05$
120 min after incision	85.61(±9.20)	82.31(±8.50)	$p>0.05$
135 min after incision	82.91(±7.80)	79.31(±7.10)	$p>0.05$
after extubation	91.91(±14.10)	93.71(±12.00)	$p>0.05$

Table 2: Mean Systolic Blood Pressure

	Group D	Group S	P Value
base line	123.56(±13.02)	124.7(±11.45)	$p>0.05$
post induction	117.43(±14.61)	120.76(±15.01)	$p>0.05$
1 min after intubation	122.63(±14.45)	125.86(±13.88)	$p>0.05$
5 min after intubation	109.13(±11.90)	107.93(±11.31)	$p>0.05$
at skin incision	113.3(±13.54)	111.63(±11.67)	$p>0.05$
5 min after incision	118.3(±12.16)	118.86(±10.33)	$p>0.05$
10 min after incision	124.96(±13.87)	121.36(±13.35)	$p>0.05$
30 min after incision	122.9(±13.79)	118.63(±13.35)	$p>0.05$
45 min after incision	123.76(±12.48i	118.6(±11.55)	$p>0.05$
60 min after incision	123.03(±12.93)	119.03(±13.59)	$p>0.05$
75 min after incision	121.37(±11.69)	116.29(±11.11)	$p>0.05$
90 min after incision	122.09(±11.33)	117.71(±9.96)	$p>0.05$
105 min after incision	120(±8.95)	117.78(±9.98)	$p>0.05$
120 min after incision	120.72(±9.22)	116(±8.88)	$p>0.05$
135 min after incision	126.1(±15.72)	120.35(±11.99)	$p>0.05$
after extubation	126.43(±9.35)	124.46(±9.46)	$p>0.05$

Table 3: Mean Diastolic Blood Pressure

	Group D	Group S	P value
base line	78.96(±9.11)	81.83(±8.69)	$p>0.05$
post induction	80.33(±11.80)	81(±11.40)	$p>0.05$
1 min after intubation	81.9(9.80)	84.76(11.67)	$p>0.05$
5 min after intubation	74.46(11.88)	73.9(8.99)	$p>0.05$
at skin incision	76.66(13.33)	79.23(10.65)	$p>0.05$
5 min after incision	82.93(12.16)	85(8.02)	$p>0.05$
10 min after incision	86.8(10.01)	82.93(8.94)	$p>0.05$
30 min after incision	82.23(12.74)	84.13(8.01)	$p>0.05$
45 min after incision	84.3(9.60)	82.7(9.48)	$p>0.05$
60 min after incision	83.23(9.06)	82.84(10.31)	$p>0.05$
75 min after incision	80.5(8.67)	82.16(14.46)	$p>0.05$
90 min after incision	80.13(9.83)	81.66(I5.12)	$p>0.05$
105 min after incision	79.82(8.49)	81.57(16.01)	$p>0.05$
120 min after incision	82.82(10.33)	78.2(6.09)	$p>0.05$
135 min after incision	81.55(9.92)	80.35(7.72)	$p>0.05$
after extubation	81.86(7.51)	84.33(10.95)	$p>0.05$

Table 4: Mean of Mean Arterial Blood Pressure

Mean map	Group D	Group S	P value
base line	93.81(±10.6)	97.50(±10.71)	$p>0.05$
post induction	93.766(±12.11)	987041261)	$p>0.05$
1 min after intubation	95.71(±12.92)	101.41(±13.12)	$p>0.05$
5 min after intubation	88.11(±10.80)	86.81(38.81)	$p>0.05$
at skin incision	91.50(±11.62)	90.61410.81)	$p>0.05$
5 min after incision	96.4333(311.01)	9881(39.12)	$p>0.05$
10 min after incision	100.61(110.12)	100.42412.82)	$p>0.05$
30 min after incision	99.51(*10o)	97.72(39.41)	$p>0.05$
45 min after incision	99.11(19.41)	04.80(11161)	$p>0.05$
60 min after incision	98.22(310.51)	97.12411.20)	$p>0.05$
75 min after incision	96.7140.11)	93.22(±820)	$p>0.05$
90 min after incision	9630(3931)	94.24(38.20)	$p>0.05$
105 min after incision	95.71(±8.21)	93.414721)	$p>0.05$
120 min after incision	98.21(310.42)	9431(35.91)	$p>0.05$
135 min after incision	97.80414.11)	94.02(±1042)	$p>0.05$
after extubation	98.13(3531)	986147.81)	$p>0.05$

Table 5: Number of patients requiring rescue drug intraoperatively

Column	Group D	Group S
Number of pts required fentanyl	6420%)	4(13.3%)
Number of pts required metoprolol	1(3.33%)	1(3.33%)

Table 6: Side Effects

Side effects/adverse effects:	No of pts in Group D	No of pts in Group S
Nausea	0	0
Vomiting	0	0
Steams	0	0
Arrhythmias	0	0
Hypotension	0	0
Bradycardia	0	0
Hypertension	6	4
Tachycardia	1	1
Cough	0	0
Sore throat	0	0

Discussion

An ideal anaesthetic agent for expeditious recovery and discharge should provide both intraoperative stable haemodynamic parameters and faster emergence and recovery. In our study, we have compared intraoperative haemodynamic parameters and side effects associated with desflurane and sevoflurane anaesthesia. Sevoflurane causes a dose dependent decrease in cardiac output and reduction in systemic vascular resistance which results in fall in blood pressure with minimal effects on heart rate. Desflurane also causes decrease in systemic vascular resistance and fall in blood pressure where cardiac output remains relatively unchanged. Rapid increase in desflurane concentration can lead to transient but sometimes worrisome increase in heart rate, blood pressure and catecholamine release by causing increase in sympathetic nerve activity. So, we compared the haemodynamic parameters like HR, SBP, DBP and MAP. In our study, we observed no statistically significant difference in HR, MAP between both the groups at any time interval ($p>0.05$). Most of the studies having result almost similar with our study are discussed further. Jindal R *et al.* (2015) [12] observed that there was no statistical difference in the intraoperative HR and mean arterial blood pressure between the groups. Mayur Patel *et al.* (2015) [4] conducted study in which they observed that both, desflurane and sevoflurane provide haemodynamic stability during intraoperative period. During the maintenance period, heart rate and MAP were satisfactorily maintained within 20% of baseline values with desflurane and sevoflurane. Amandeep Kaur *et al.* (2013) [2] conducted study in which they observed that intraoperative haemodynamic parameters did not differ in the two groups during the course of anaesthesia and were successfully maintained within 20% of baseline values with desflurane and sevoflurane. Federico bilotta *et al.* (2009) [5] conducted study in which they observed that incidence of intraoperative hypotension, hypertension, bradycardia and tachycardia during induction and maintenance of anaesthesia were similar in both the group. The intra operative use of vasoactive drugs to manipulate MAP within 20% difference from baseline was less frequent in patient assigned to sevoflurane than in those assigned to desflurane. Vairavarajan *et al.* (2016) [1] conducted study in which they observed that both the desflurane and sevoflurane maintained the haemodynamics within 20% of the baseline values, but desflurane required more number of additional doses of fentanyl than sevoflurane.

All the patients were observed for side effects and adverse effects during intraoperative and postoperative period. None of the patients in either group had side effects like hypotension, bradycardia, nausea, vomiting, arrhythmias,

shivering, cough, sore throat. This result was similar to other studies as discussed further. Ravi Jindal *et al.* (2015) [6] observed that Incidence of postoperative complications like nausea, vomiting, drowsiness, respiratory distress and sore throat were comparable with desflurane and sevoflurane. Gildasio S. De Oliveria *et al.* (2013) [7] conducted study in which they observed that the frequency and severity of cough, laryngospasm, sore throat and hoarseness did not differ with desflurane and sevoflurane anaesthesia. Mayur Patel *et al.* (2015) [4] conducted study in which they observed that there was no difference in the incidence of complications like postoperative incidence of nausea, vomiting, drowsiness, respiratory distress, laryngospasm, sore throat, and headache in both the groups. N. A. Mahmoud *et al.* (2001) [8] conducted study in which they observed that there were five untoward airway events in the desflurane group (two hiccoughs, three coughing) and three in the sevoflurane group (two hiccoughs, one laryngospasm) when used during day care anaesthesia with spontaneous respiration.

Conclusion

Thus, it can be concluded that desflurane and sevoflurane as a maintainance agent during laparoscopic surgery were comparable with respect to intraoperative haemodynamics parameters and perioperative complications.

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