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International Journal of Current Research
Vol. 9, Issue, 12, pp.63671-63677, December, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

RECOVERY AFTER SEVOFLURANE VERSUS DESFLURANE ANAESTHESIA IN INDIAN ADULT PATIENTS: A COMPARATIVE STUDY

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ARTICLE INFO

Article History:
Received 12th September, 2017
Received in revised form
23rd October, 2017
Accepted 06th November, 2017
Published online 31st December, 2017

Key words:
Anesthesia,
ASA Grade I/ II,
Side effects.

ABSTRACT

Introduction: Comparative study of recovery after sevoflurane versus desflurane anaesthesia in adult patients during the surgery and side effects observed during and after anaesthesia.
Materials and Methods: Patients in the age group of 20-55 years, having ASA 1 and ASA 2, scheduled for elective surgery were included &randomly divided into two groups' i.e Group I-Sevoflurane receiving group and Group II-Desflurane receiving group and patients with clinically significant cardiovascular & a history of allergic reactions to drugs were excluded.
Observations and Results: At induction, a sudden rise observed in mean heart rate of patients in Group I showing a significant intergroup difference ($p<0.001$). It was observed that at induction mean heart rate of Group II was significantly lower as compared to that of Group I ($p<0.001$) whereas at 70 min, 80 min, 90 min and 100 min time intervals respectively mean heart rate in Group II was significantly higher as compared to that of Group I ($p<0.05$). After induction, a significant fall in both mean SBP and DBP were observed in both the groups but the fall was higher in Group II as compared to Group I thus leading to a significant difference between two groups ($p<0.001$). Nausea & vomiting was the most common side effect while sore throat and headache were some of the less common side effects. No significant difference was observed between two groups for any of the side effects.
Conclusion: It can be concluded that both drugs provided similar intraoperative condition during maintenance period but early recovery was more rapid with Desflurane compared to Sevoflurane.

Citation: Dr. Krishna Prasad, G. V. and Dr. Sankaranand, P. 2017. "Recovery after sevoflurane versus desflurane anaesthesia in Indian adult patients: A comparative study", *International Journal of Current Research*, 9, (12), 63671-63677.

INTRODUCTION

When the general anesthesia is administered to an adult patient planned for surgery, the objective is to achieve optimal surgical conditions in terms ofanesthesia, analgesia and proper muscle relaxation, while ensuring rapid recovery from the anesthesia, when a regular breathing pattern is re-established and patientresponds to command as also rapidly resumes regular activities of day to day living. The goal is to ensure rapid recovery without side effects. Both, desflurane (Suprane) as well as sevoflurane are currently in extensive clinical use for maintenance of anesthesia in adult patients. Although studies have consistently reported a faster recovery with the usage of anesthetic desflurane than sevoflurane, the impact of these turbulent anesthetics on upcoming recovery end points was not consistently compatible in all studies (Song *et al*., 1998; Mahmoud *et al*., 2001; Strum *et al*., 2004; Nathanson *et al*., 1995; Heavner *et al*., 2003; Chen *et al*., 2001). Song *et al*. (1998) reported that the maximum number of patients receiving desflurane for maintenance of anesthesia were having short early recovery, however, later recovery times were almost the same for the two volatile anesthetics. Mahmoud *et al*. (2001) reported in their study about the usage of desflurane in minor outpatient (OP) gynecological surgeries, which resulted not only in a faster emergence but also smooth recovery of common activity after operationas compared to sevoflurane. A similar later recovery time for the two volatile anesthetics, desflurane and sevoflurane has also not been repoted by other authors. (Strum *et al*., 2004; Nathanson *et al*., 1995; Heavner *et al*., 2003; Chen *et al*., 2001) Strum *et al*. (2004) reported that although patients anesthetized with desflurane showed significantly faster recovery for response to instructions enabling prompt tracheal extubation, unlike the patients anesthetized with sevoflurane, the recovery score was higher in patients anesthetized with desflurane. The concomitant administration of centrally active adjuvant drugs (e.g., benzodiazepines, opioid analgesics, and nitrous oxide), also muscle calmant and reversal drugs, might explain the contrast in these studies. Moreover, the reported relative incidences of side effects like cough, throughout the course of these two volatile anesthetics for continuation of anesthesia were not

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consistent in various studies. (Apfel *et al*., 2005; Song *et al*., 1998) In every ten patientstwo or three of them suffered from postoperative nausea and vomiting (PONV) after general anaesthesia with volatile anesthetics, Apfel *et al*. (2005) reported that volatile anesthetics were emetogenic (causing nausea and vomiting) and there were no meaningful differences between the two in that respect. Author also reported that the validation of the anti-emetics was also unconventional of volatile anesthetics used and thatany anti-emetic prophylaxis for nausea, influenced by volatile anesthetics was equally effective. On the contrary, Song *et al*. (1998) reported that an endovenous quantity of propofol administered at the end surgery was more effective in preventing postoperative nausea and vomiting after a sevoflurane-based anesthetic, as compared with a desflurane-based anesthetic. In light of the above facts, a prospective, randomised, uncontrolled comparative study was designed to evaluate the hypothesis that the desflurane used for continuation of anesthesia had shorter recovery periods than sevoflurane and resulted in higher number of patients regaining normal activities of their day to day living, on the first day after ambulation as compared to sevoflurane. Second objective of the study was to assess and compare the effects of desflurane as well as Sevoflurane in nitrous oxide anaesthesia on haemodynamic changes of the anaesthesised adult patients during the surgery as also side effects during and after anaesthesia.

Aims and Objectives

1. To compare the effects of haemodynamic changes of Sevoflurane against Desflurane in nitrous oxide anaesthesia.
2. To compare the recovery features of Sevoflurane against Desflurane in nitrous oxide anaesthesia.
3. To compare most frequent side effects after surgery by using Sevoflurane as against Desflurane in nitrous oxide anaesthesia.

MATERIALS AND METHODS

It is a prospective, randomised, uncontrolled, comparative study made for a period of two years at Command Hospital Air Force (CHAF), Bangalore in Anaesthesiology Departmentof critical care. All the patients of age group 20-55 years, having ASA 1 and ASA 2, scheduled for elective surgery, were considered eligible for participation in the study. The type of the surgery, organ system involved did not affect inclusion probability of the case in the study. The sampling of the cases was made by simple randomization based on a machine generated arbitrary number table, without blinding. The patients were randomly split in two groups' i.e Group I-Sevoflurane receiving group and Group II-Desflurane receiving group.

Exclusion criteria adopted during the study

- The patients werearranged for elective surgery based on clinically significant cardiovascular, respiratory, hepatic, renal, neurologic, psychiatric and metabolic disease or those who had undergone a recent anaesthetic procedure (within past 7 days)
- Patients with history of allergic reactions to drugs and patients chronically receiving opioid analgesics or sedative medications

Written consent was asked from all these patients for enrolling in the study. All these patients were subjected to a routine pre-anaesthetic evaluation (PA checkup) prior to surgery. Detailed medical history and demographic information including their age, weight, height, alcohol or drug consumption history including smoking, postoperative nausea and vomiting (PONV), or body shifting sickness, and ability to perform normal physical activities of daily livingwere elicited from the patients. Before surgery, the pain and nausea were recorded on verbal grading scale starting from 0 to 10. Anesthetic and hemodynamic variables were recorded before anesthetic management, at 10 minutes intermissionfrom injection of anesthesia until theend of operation. One nominated invigilatormanaged all anaesthesia; whereas another assessed the recovery. 0.05 mg / kg Midazolam intravenously premadicated was administered to all the patients thirty minutes before surgery. Patients were constantly monitored by using ECG, non-invasive blood pressure (NIBP), pulse oximetry, end-tidal carbon dioxide ($ETCO_2$), end-tidal Sevoflurane (ET_{sevo}) and end-tidal Desflurane (ET_{des}) (AMS CAMS II anaesthesia monitor). Patients were separated in two categories to be subjected to either Sevoflurane 2 % or Desflurane 3 % for administration of general anaesthesia with nitrous oxide 66 % in oxygen through a semi closed system after uniform induction serieshaving fentanyl 2μ g kg^{-1}, Thiopental 5 mg / kg thenVecuronium 0.1 mg / kg intravenously. After endotracheal intubation, oxygenation was supervised to maintain $ETCO_2$ ranging 35 to 40 mmHg. Accommodation of volatile anaestheticassemblage was done to maintain the mean arterial blood pressure (MAP) and heart rate (HR) within 20 % of the preinduction baseline values or by clinical signs of light anaesthesia (lacrimation, flushing or sweating). ET_{sevo} and ET_{des} concentration was increased by increments of 1.0 %. If MAP or HR remains on higher side after 5 min, additional quantity of fentanyl (0.5 μg / kg) was injected. Atropine 0.5 mg wasinjected intravenously when HRfell below 50 beats/ min. Inhalational anaesthetics were reduced only when hypotension not showing any response to replacement of intraoperative fluid loss or treatment of bradycardia. Vecuronium was given for neuromuscular blockade, as determined by one twitch visible of the train- of- four. All incidents of coughing after induction ofanesthesiauntil the patients were awake and positioned were registered by a blinded spectator.

Anesthesia was injectedwith fentanyl 2μ g kg^{-1}, Thiopental 5 mg / kg and Vecuronium 0.1 mg / kg intravenously. After an LMA was installed, studied patients were randomly chosen to accept either sevoflurane 2%–3% supreme or desflurane 6%–8% supreme in a 50:50 air/oxygen brew for initial continuity of anesthesia at anentire gas flow rate of 3 L/minute. The inspired assemblage of sevoflurane or desflurane were finally adjusted to continue a clinically acceptable "depth of anesthesia" (i.e., providing good surgical conditions) while maintaining a stable spontaneous respiratory rate, mean arterial blood pressure and heart rate values within 20% of the preinstallationstandard values, and a BIS value of 50–60). Before the end of surgery, ondansetron (4 mg IV), dexamethasone (4 mg IV), and metoclopramide (10 mg IV) were administered to all patients for antiemetic prophylaxis. Preventative analgesia was applied using ketorolac (30 mg IV; before the surgery end) and a local anesthetic mixturecontaining 1:1combination of 2% lidocaine and 0.5% bupivacaine was infused at the surgical openingarea before the skin opening and again at closing time. The maintenanceof anestheticswasterminated after the surgical wound was closed. On revival from anesthesia (i.e., opening of

eyes), the LMA tool was evicted, and patients were checked at 1-minutegap to make sure fortheir capabilityto undergoparticular fast-track criteria. (Magni *et al*., 2009) Nitrous oxide was stopped at the first skin seam. At the last skin seam, the volatile agent was discontinued and controlled oxygenation with cent % oxygen 8 l / minutewas maintained until end-tidal volatile anaesthetic assemblagecame below 0.1 %. Left over neuromuscular siege was transposed with amalgamation of Neostigmine and Glycopyrrolate intravenously. The time at which the anaesthetic agents were discontinued was noted down as zero time for all successive measurements and retrieval times. Surgeons were asked to assess the skin closure conditions after operationwith a 3-point VRS: 2= highly satisfied, 1= satisfied and 0= dissatisfied. When a relaxed and regular breathing pattern was restored and when patients were able to open their eyes on instructions, the trachea was extubated. The first spontaneous motion and response to painful pinch was noted. To squeeze fingers and speak out their names were the other task for the patients. The sitting time, time during standing and ambulating without help, and consuming oral fluids were evaluated at 10-min gaps in the recovery room ahead of discharge. The time span of the recovery, stay and the time of discharge were also noted from the time of discontinuation of anesthesia (i.e. discontinuation of the volatile anesthetics). Criteria required that the patients were awake and attentive with stable essential signs during discharge and could ambulate without any help, as also did not complainof any acute side effects (e.g., nausea or vomiting) or moderate-to-severe pain. (Magni *et al*., 2009) Achieve a PARS > 10 (post anesthesia recovery score of Aldrete and Kroulik) PARS registers essential signs with patients getting 0-18 points that is 0-3 points for five physiological variables. One designated invigilator had checked all anesthesia; another had evaluated recovery.

Statistical analysis

The statistical analysis was carriedout using SPSS (Statistical Package for Social Sciences) Version 23.0 statistical Analysis Software. The values were represented in Number (%) and Mean±SD. The student's t-test and chi square test were made to determine the statistical significance of the contrastamong the two groups. $P < 0.05$ was considered significant.

RESULTS

A total of 120 patients were enrolled in this particular study and were arbitrarily divided into two groups comprising of 60 patients each. Group I comprised of 60 patients who were managed with Sevoflurane, while Group II comprised of 60 patients was managed with Desflurane. Both the groups were comparable in respect of demographic data and time span of surgery (Table 1). Haemodynamic specifications were comparable at all phases except during induction. During induction, an unexpected increase in mean heart rate of Group I patients was observed as it reached to 79.3±5.4 bpm whereas a fall in mean heart rate of Group II was observed and it reached to 65.9±4.0 bpm showing a remarkable intergroup dissimilarity ($p<0.001$). At intubation and at subsequent intervals mean heart rate of Group I ranged from 75.9±5.7 bpm (at 100 min intraoperative interval) to 77.6±5.5 bpm at 20 min intraoperative interval whereas in Group II it ranged from 77.0±4.3 bpm (at 10 min) to 80.4±4.7 bpm at 90 min intraoperative interval. (Table 2) It was observed that at induction mean heart rate of Group II was significantly lower as compared to that of Group I ($p<0.001$) whereas at 70 min, 80 min, 90 min and 100 min time intervals mean heart rate in Group II was significantly higher as compared to that of Group I ($p<0.05$) (Table 2). Baseline, no remarkable difference in average SBP and DBP was noticed between the two groups.

Table 1. Comparison of baseline and demographic characteristics between both groups

SN	Characteristic	Group I (n=60)	Group II (n=60)	Significance of difference
1.	Mean Age±SD (Range) in years	37.20±12.12 (20-55)	35.80±11.20 (20-55)	t=0.657; p=0.512
2.	Male:Female	30:30	32:28	χ^2=0.133; p=0.715
3.	Mean Weight±SD (Range) in kg	62.78±11.41 (42-87)	64.60±9.27 (45-82)	t=0.957; p=0.341
	ASA Grade			
4.	I	27 (45.0%)	32 (53.3%)	χ^2=0.834; p=0.361
	II	33 (55.0%)	28 (46.7%)	
5.	Mean duration of surgery±SD (Range) in minutes	99.17±42.63 (40-190)	88.58±35.42 (30-160)	t=1.479; p=0.142

Group I-Sevoflurane receiving group and Group II-Desflurane receiving group

Table 2. Distribution of comparison of heart rate (bpm) between two groups at different time intervals

SN	Time interval	Group I (n=60)			Group II (n=60)			Significance of difference	
		n	Mean	SD	n	Mean	SD	"t"	"p"
1	Preop.	60	74.1	6.1	60	73.1	4.1	1.094	0.276
2	Induction	60	79.3	5.4	60	65.9	4.0	15.423	<0.001
3	Intubation	60	86.9	4.9	60	87.2	5.1	-0.293	0.770
4	10 min	60	76.5	5.4	60	77.0	4.3	-0.524	0.601
5	20 min	60	77.6	5.5	59	78.1	4.4	-0.519	0.605
6	30 min	59	77.5	5.6	59	78.8	4.6	-1.364	0.175
7	40 min	55	77.1	5.1	59	78.8	4.4	-1.964	0.052
8	50 min	46	77.0	5.5	38	78.9	4.7	-1.715	0.090
9	60 min	38	77.0	5.4	37	79.2	4.8	-1.798	0.076
10	70 min	33	77.1	5.3	35	79.6	4.1	-2.172	0.033
11	80 min	31	76.9	5.2	34	79.8	4.1	-2.450	0.017
12	90 min	28	77.4	5.6	34	80.4	4.7	-2.215	0.031
13	100 min	19	75.9	5.7	29	79.7	4.5	-2.420	0.020
14	110 min	17	76.0	5.9	27	79.4	5.1	-1.955	0.057
15	120 min	17	76.5	5.9	27	79.1	5.0	-1.483	0.146

Group I-Sevoflurane receiving group and Group II-Desflurane receiving group

Table 3. Comparison of MAP (mm Hg) between two groups at different time intervals

SN	Time interval	Group I (n=60)			Group II (n=60)			Significance of difference	
		N	Mean	SD	n	Mean	SD	"t"	"p"
1	Preop.	60	93.2	4.4	60	92.4	3.0	-1.132	0.260
2	Induction	60	84.5	3.5	60	79.7	10.6	-3.343	0.001
3	Intubation	60	99.9	12.6	60	101.8	2.3	1.135	0.259
4	10 min	60	94.5	4.4	60	94.4	2.4	-0.208	-0.836
5	20 min	58	95.2	3.4	60	93.9	2.4	-2.485	0.014
6	30 min	57	95.8	3.1	60	94.4	2.4	-2.726	0.007
7	40 min	54	95.5	3.3	59	94.8	2.3	-1.290	0.200
8	50 min	46	96.2	3.0	38	94.3	2.6	-3.058	0.003
9	60 min	38	96.2	2.9	36	94.7	2.2	-2.480	0.015
10	70 min	33	96.4	2.8	34	94.4	2.1	-3.353	0.001
11	80 min	30	96.5	2.7	33	94.9	2.3	-2.540	0.014
12	90 min	28	96.8	2.8	33	94.3	2.5	-3.574	0.001
13	100 min	19	96.9	3.2	27	94.2	1.9	-3.203	0.003
14	110 min	18	97.3	2.9	26	88.6	20.0	-2.198	0.034
15	120 min	18	97.0	2.0	26	93.5	2.9	-4.818	<0.001

Group I-Sevoflurane receiving group and Group II-Desflurane receiving group

Table 4. Comparison of Time Taken for recovery to different landmarks (values in mm:ss)

S.No.	Landmark	Group I (n=60)		Group II (n=60)		Significance of difference	
		Mean	SD	Mean	SD	"t"	"p"
1.	Spontaneous breathing	4:57	0:16	3:20	0:16	32.162	<0.001
2.	Opening of eyes on command	6:06	0:20	4:19	0:22	26.717	<0.001
3.	Response to pain	7:15	0:23	5:26	0:21	26.228	<0.001
4.	Spontaneous motion	8:26	0:24	6:34	0:21	26.888	<0.001
5.	Tell their names	9:46	0:25	7:38	0:24	28.315	<0.001
6.	PARS >10	11:42	0:32	8:51	0:23	32.928	<0.001

Group I-Sevoflurane receiving group and Group II-Desflurane receiving group

Table 5 Comparison of Side effects

S.No.	Landmark	Group I (n=60)		Group II (n=60)		Significance of difference	
		No.	%	No.	%	χ^2	"p"
1.	Nausea/Vomiting	7	11.7	10	16.7	0.617	0.432
2.	Drowsiness	–	–	–	–	–	–
3.	Resp. distress and laryngospasm	–	–	–	–	–	–
4.	Sore throat	4	6.7	8	13.3	1.481	0.224
5.	Headache	4	6.7	3	5.0	0.152	0.697

Group I-Sevoflurane receiving group and Group II-Desflurane receiving group

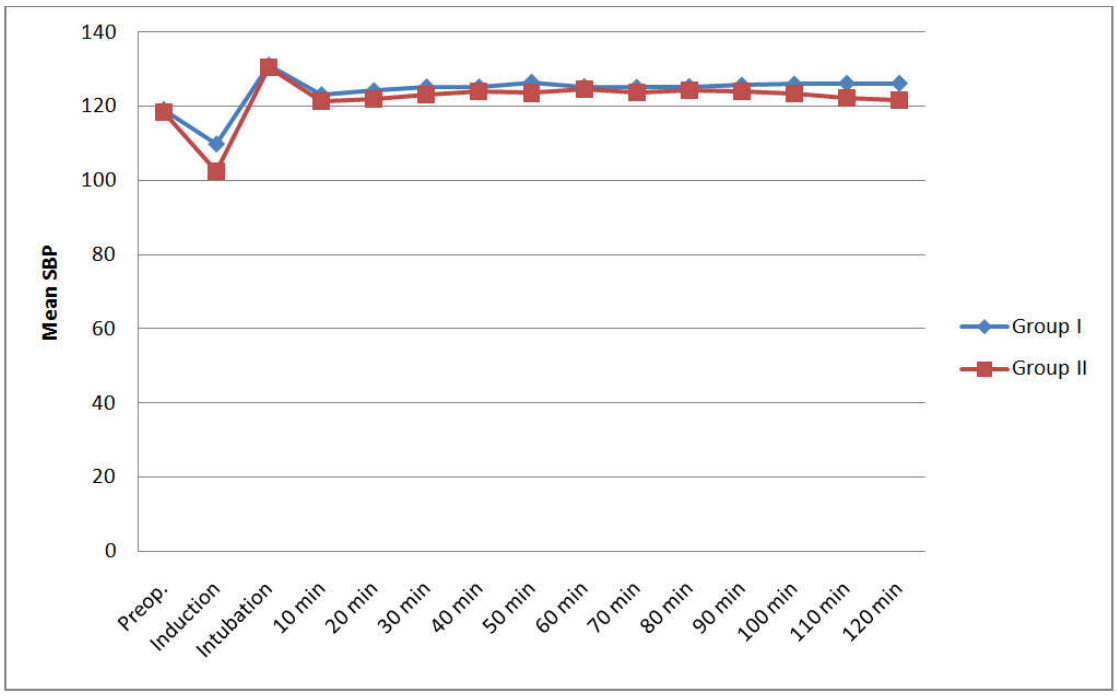

Figure 1. SBP (mm Hg) comparison between two groups at different time intervals

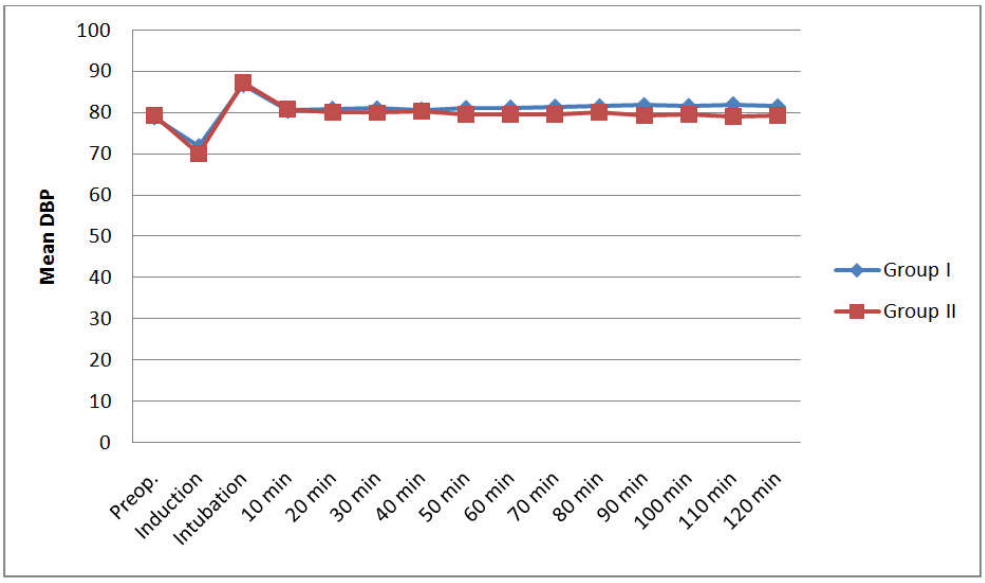

Figure 2. DBP (mm Hg) comparison between two groups at different time intervals

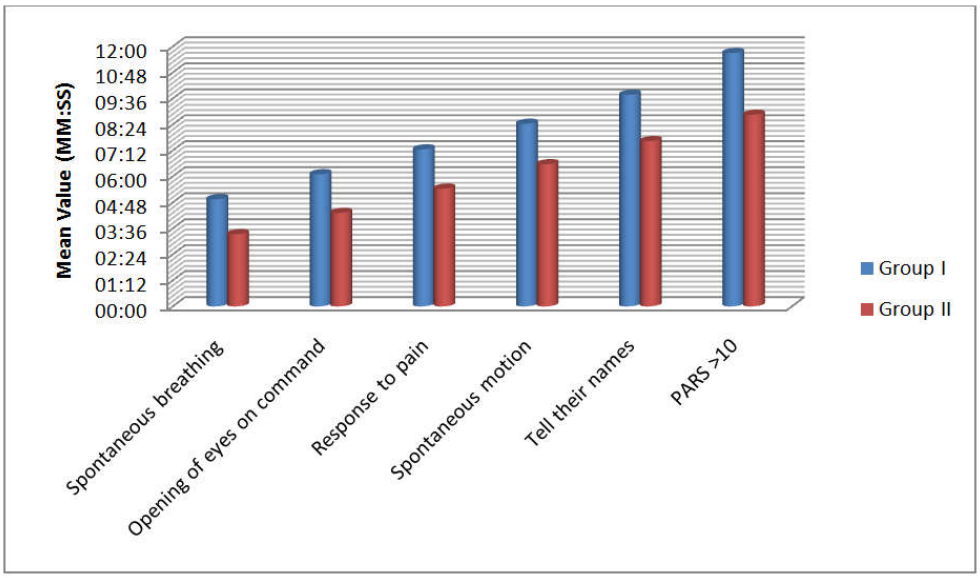

Figure 3. Comparison of Time Taken for recovery to different landmarks

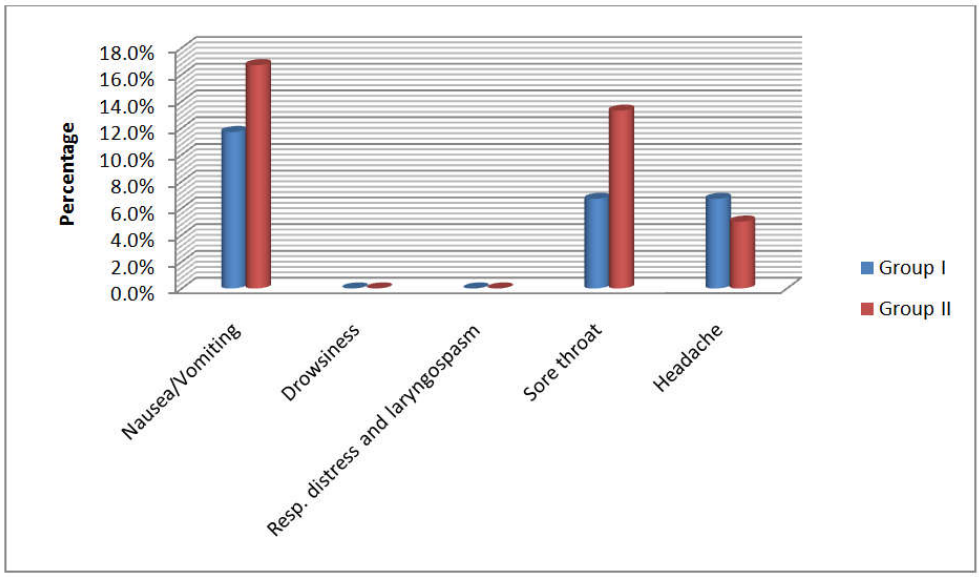

Figure 4. Side effects of patients of groups

However, after induction, a notabledrop in both mean SBP and mean DBP was noticed in both the group but the fall was higher in Group II as compared to Group I thus leading to a remarkable difference between the patients of the two groups ($p<0.001$). However, by intubation both the groups showed a rise in mean SBP and DBP leading toa cessation of remarkable difference between the groups. Further mean MAP ofthe two groups did not show a significant difference ($p=0.260$). However, at induction, both the groups showed a fall in mean MAP, more so in Group II as compared to Group I, thus demonstrating aremarkable difference among the groups. At intubation, in each group a sudden rise in mean MAP was observed, however, the difference between the two groups was not statistically significant. At 10 min following a slight fall in mean MAP, difference betweenthe two groups was statistically insignificant ($p=0.836$). However, after time interval of 20 minutes till the end of follow up at 120 min (except at 40 min interval), mean MAP of Group II was significantly lower as compared to that of Group I ($p<0.05$). At 40 min interval too, mean MAP of Group II was lower as compared to that of Group I difference between the two groups was statistically insignificant ($p>0.05$). (Table 3) Nausea & vomiting was the common side effects in both group I and group IIand none of the patients complained of drowsiness and respiratory distress with laryngospasm. Sore throat and headache were a few common side effects reported. No remarkable difference was noticedamong the two groups for any of the side effects. (Table 5)

DISCUSSION

In pediatric patients general anesthesia is normally given through an inhaled anesthetic, whichimparts a rapid and smooth induction and emergence, hemodynamic stability, analgesia, as well as amnesia. The present study demonstrated that Desflurane precedes over sevoflurane in regard to early recovery from anesthesiataking into consideration that desflurane solubility in blood is very low (0.42), this was not at all surprising. The results of this study fully supportedthe findings of earlier study by Mahmoud *et al*. (2001) detailing that the speedy recovery after termination of desflurane leads to an early discharge and much promptretrieval of day to day activities as compared to sevoflurane. Previous studies comparing desflurane to sevoflurane, have described a lowprevalence of respiratory problemsand no remarkable difference between the two volatile anesthetics (Mahmoud *et al*., 2001; Song *et al*., 1998; Eshima *et al*., 2003; Macario *et al*., 2005). This was similar to the clinical findings of our study. No remarkable contrast wasnoticed betweenthe two groups of anesthetics in respect of any of the side effects. Arain *et al*. (Heavner *et al*., 2003) also described that the airway reactions by desflurane and sevoflurane were discreet and didnot make any differencebetween the two anesthetics. However, contrary to our conclusions, Klock *et al*. (Apfel *et al*., 2005) reported that, sevoflurane was dominant over desflurane for prevention of clinically related cough reactions to tracheal stimulation. A study by McKay *et al*. (Song *et al*., 1998) suggested that amongcigarette smoking patients, use of desflurane or sevoflurane, increased patients'risk of coughing and respiratory problems. In our study, we used injected series consisting of fentanyl 2μ g kg^{-1}, Thiopental 5 mg / kg and Vecuronium 0.1 mg / kg intravenously. It was very likely that the use of fentanyl at intraoperative period might have diminished the contrast between the airway responses to desflurane and sevoflurane. Other studies which have reported similar airway responses have also used fentanyl or similar opioid agent for induction. (Mahmoud *et al*., 2001; Eshima *et al*., 2003; Arain *et al*., 2005; Saros *et al*., 2006; Kong *et al*., 2000) In the study made by white *et al*. (White *et al*., 2009), although no opioid analgesics were administered, yet the overall incidence of coughing was significantly higher in patients receiving desflurane (versus sevoflurane) despite the use of lower anesthetic concentrations of the volatile anesthetics.

Two distinct cardiovascular effects (Weiskopf, 1995) of Desflurane have been established, firstly, desflurane reduces left ventricular systolic and diastolic role to some extent same assevoflurane and alsoit reduces systemic vascular resistance and mean arterial blood pressure in a dose-dependent fashion. Heart rateremained unchanged at lower steady-state concentrations; however it increased with higher concentrations. During the study, it was observed that at induction mean heart rate of the desflurane group was significantly lower as compared to that of sevoflurane group ($p<0.001$) whereas at 70 min, 80 min, 90 min and 100 min time intervals, the mean heart rate in desflurane Group was significantly higher as compared to sevoflurane group ($p<0.05$). It is well known that in absence of premedication, desflurane increases sympathetic activity, heart rate. We may explain this observation as we used fentanyl for induction which would have blunted the influence of desflurane on sympathetic activity during first hour, there by maintaining the heart rate. In the study carried out by Arain (Arain *et al*., 2005) [i] *et al* on the comparison of sevoflurane to desflurane in obese patient, the observed difference in the findings could be attributed to the difference in the time span of the surgery and ASA SCORE of the studied patients. In our study, the mean time span of the study was about 90 min and patients had ASA SCORE 1 and 2 only and there was no statistical difference in the mean heart rate of both the groups in first 70 min, the difference in the mean heart rate was observed onlyfrom 70 min to 100 min duration. In the report by Arain *et al*. (2005) the total duration of surgery was about 3.5 hours and the patients had an ASA SCORE 2 and 3 which might explain the difference in the observations. There were no more comparable studiesencountered on the issue in adult patients.

The changes in the blood pressure in the two study groups were not statistically significant, leading us to conclude that the two anesthetics agents in question did have aneffect on the mean blood pressure of the patient. Though desfurane is known to cause dose-related reduction in systemic vascular opposition and mean arterial pressure, fentanyl used for induction could be the cause for the blunted effect of desflurane. The time to natural motion, opening of eyes, reaction to pain was lesser in the desflurane group. Extubationtime and recall of name, were also lesser in the desflurane group as compared to sevoflurane group. Post anesthesia recovery score > 10 was accomplished earlier in the desflurane group. In this group, patient moved their arms and legs in an average time of 6 min after the termination of the anesthetics, and it took about an average 8 min in the sevoflurane group for the same. Similarly intheir study Chandrasekaran and Sudha (2016) reported shorter spontaneous motion mean time in desflurane than sevoflurane. The study by Nathanson *et al*. (1995) indicated that sevoflurane and desfluranehad givenalmost same intraoperative conditions through the maintenance period. Although recovery was speedy after desflurane, there was no difference in later recovery end-points. Faster emergence was showed by patients in desflurane group resulting in significantly faster resumption of day to day

activities when compared with those with sevoflurane group. The occurrence of coughing was almost same with both volatile anesthetics during the maintenance period; however, overall, no difference was found in regard to the occurrence of postoperative nausea or the need for antiemetic medication. Maintenance of anesthesia with the desflurane or sevofluraneenables for a quick recovery after major surgery procedures in adult patients.

In conclusion, it could be stated that there was no distinctive effect of these anaethetic agents on changes observed during the course of anaesthesia. Nausea appeared to develop shortly in desfluranepatients, with the earlier awakening allowedperhaps due to desflurane's lower solubility (Strum *et al*., 2004). It can thus be concluded that both constribute to almost same intraoperative conditions during maintenance period but early recovery was faster with Desfluraneas compared to Sevoflurane.

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